

COMMANDER NAVAL SURFACE FORCE  
UNITED STATES ATLANTIC FLEET  
1430 MITSCHER AVENUE  
NORFOLK, VIRGINIA 23551-2494

AND

COMMANDER NAVAL SURFACE FORCE  
UNITED STATES PACIFIC FLEET  
2841 RENDOVA ROAD  
SAN DIEGO, CALIFORNIA 92155-5490

AND

COMMANDER NAVAL AIR FORCE  
UNITED STATES PACIFIC FLEET  
NAVAL AIR STATION, NORTH ISLAND  
P.O. BOX 357051  
SAN DIEGO, CALIFORNIA 92135-7051

AND

COMMANDER NAVAL AIR FORCE  
UNITED STATES ATLANTIC FLEET  
1279 FRANKLIN STREET  
NORFOLK, VIRGINIA 23511-2494

COMNAVSURFLANT/COMNAVSURFPAC/  
COMNAVAIRPAC/COMNAVAIRLANTINST 3530.4A  
CNSL N3/CNSP N3/CNAP N3/CNAL N3  
12 MAR 1999

COMNAVSURFLANT/COMNAVSURFPAC/COMNAVAIRPAC/COMNAVAIRLANTINST 3530.4A

Subj: SURFACE SHIP NAVIGATION DEPARTMENT ORGANIZATION AND REGULATIONS MANUAL

1. Purpose. To publish joint navigation guidelines to be observed by COMNAVSURFPAC, COMNAVAIRPAC, COMNAVSURFLANT, and COMNAVAIRLANT vessels.

2. Cancellation. COMNAVSURFLANT/COMNAVSURFPAC/COMNAVAIRPAC/  
COMNAVAIRLANTINST 3530.4

3. Revision. Changes are extensive and individual paragraphs have not been marked with A, D or R. Therefore it is necessary to review this instruction in its entirety. Recommendations for changes, additions or deletions should be forwarded to your respective type commander.

4. Action

a. Effective upon receipt, this instruction will be used to improve navigational accuracy. Personnel assigned responsibility for navigation duties are required to read and demonstrate knowledge of the contents of this instruction before assuming these duties.

b. Annual checkrides are no longer required but may be requested at the discretion of the Commanding Officer. Appendix A provides detailed guidance for standards of safe navigation on board U.S. Navy vessels. CVN's use COMNAVAIRLANT/COMNAVAIRPACINST 3500.20B.

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12 MAR 1999

c. Each Commanding Officer will tailor Chapter 2 of this instruction as necessary to conform with the ship's configuration and organization; and issue it as the ship's Navigation Bill.

"Signed"

G. M. ERICKSON  
Deputy and  
Chief of Staff  
COMNAVSURFPAC

"Signed"

R. P. PERRY  
Deputy and  
Chief of Staff  
COMNAVSURFLANT

"Signed"

R. L. LEITZEL  
Chief of Staff  
COMNAVAIRLANT

"Signed"

R. A. DEAL  
Chief of Staff  
COMNAVAIRPAC

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32C2 Ammunition Ship PAC (AE)

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32X2 Salvage Ship PAC (ARS)  
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32EE2 Submarine Rescue Ship PAC (ASR)  
32KK Miscellaneous Command Ship (AGF) (USS CORONADO only)  
32QQ2 Salvage and Rescue Ship PAC (ATS)  
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RECORD OF CHANGES

Change Number	Date of Change	Date Entered	Person Entering Change

LIST OF EFFECTIVE PAGES

The following is a list of pages in effect. "0" indicates the original as printed in this edition.

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H-1 - H-2	0		
I-1 - I-4	0		

CHAPTER 1

INTRODUCTION

1. Background. While special significance must always be placed on piloting in restricted waters, the advent of Over-the-Horizon Targeting (OTH-T), increasing use of Direct Support (DS) operations, and routine rendezvousing under EMCON conditions have caused increasing emphasis to be placed on open ocean navigation. Complex tactical operations which combine surface forces with submarines and long-range ASW aircraft now demand accurate navigation not previously required. Studies have shown that navigation accuracy can be adversely affected by a number of factors, including:

- a. Accumulation of errors in information flow.
- b. Deteriorated expertise in conventional navigation techniques because of excessive dependence on electronic navigation.
- c. Lack of proper emphasis on navigation accuracy.
- d. Improper determination of set and drift and failure to properly apply set and drift to Dead Reckoned positions.
- e. Improperly calibrated EM log and inaccurate or improper azimuth reference.

In light of a greater demand for navigation accuracy both at sea and in restricted waters, it is essential to continually stress proper training of navigation team personnel and strong management of the navigation picture. This instruction was developed and implemented by Type Commanders from both coasts to provide uniform standards and comprehensive instruction to achieve these ends.

2. Navigation Team organization. The Navigator must organize the navigation team so it is flexible enough to meet demands and complexities of the ship's missions. Chapter Two provides a standard navigation bill which will be tailored for each ship to delineate duties and responsibilities. While navigation detail is manned, navigation personnel will NOT abandon/leave their assigned duties without being properly relieved.

3. Non-Hostile environment. The Navigator will advise the CO and OOD of the ship's movements and of best courses to steer. He/she should operate and coordinate any subsequent maintenance of the ship's navigational equipment.

- a. The Navigator is supported by personnel whose duties and expertise support his/her responsibilities. Quartermasters support the Navigator by maintaining the DR and Ship's Deck Log and by fixing and estimating the ship's position. The OOD supports the Navigator by reporting radar and visual navigation landmark sightings. The quartermaster is a vital assistant to the OOD, who must take an active role in making sure the ship is properly and safely navigated at all times. The Combat Information Center (CIC)/Combat Direction Center (CDC) navigation team provides radar bearings and ranges to known points and tracks ships and other hazards which might



endanger the ship. The CICWO/CDCWO maintains an independent DR and track plot to support the bridge navigation efforts. CIC/CDC will maintain an effective exchange of information between the bridge, CIC/CDC and the navigation watch which will reduce or prevent errors from occurring and will aid in resolving differences.

b. The Navigator draws navigation data from all available sources to determine the ship's position and its relationship to hazards to navigation. He/she provides the CO and OOD with ship's position and recommends courses and speeds. The navigation team must strive to determine navigation data that is as accurate as possible.

c. The checklist provided in Appendix E is a guide for properly turning over a watch and for maintaining standards of accuracy. All on-coming and off-going watch QMOWs will use this guide or similar checklist.

4. Hostile environment. The navigation team is faced with additional duties when higher conditions of readiness are required, to provide the CO and Tactical Action Officer (TAO) with the timely geodetic positioning data that they may require to position the ship, acquire targets and employ all required weapons and tactics while fighting the ship. The Navigator must assume an integral role in determining position data used in tactical data systems to ensure that the most accurate navigational/position data available is provided to these systems. Numerous exercises have shown that position data supplied automatically to NTDS from inertial and navigation integrator devices results in the most geodetically accurate data links. However, the Navigator must constantly compare automatically supplied data to fix information obtained from all sources, including other ships in company and take action to override automatic data determined to be less accurate than his/her navigation team's position information. Ships Battle Bill will describe procedures to ensure that the Navigator's role in tactical situations is clearly defined.

a. In a tactical situation for ships not equipped with automatic GPS data feed to CIC/CDC, the Navigator becomes the TAO's primary source of geodetic data for the tactical plot. He/she receives inputs from all available sources to aid in developing the ship's position. He/she delivers this data to the TAO for display and/or input into the NTDS/ACDS. He/she communicates with the TAO to accommodate changes in the TAO's requirements for accuracy and precision and provides for the detection and correction of errors.

b. A necessary ingredient in the maintenance of accurate navigation throughout the entire combat system is the detection and correction of errors. This can be accomplished by the following:

(1) The navigation team will use all available navigation systems and technologies in determining a fix.

(2) The users of navigation information should continuously compare data for accuracy and provide feedback as necessary.

5. Training. Maintaining the ship's position within the normally accepted

accuracy standards found in Chapter 2, Table 2-A, demands an aggressive training program for all personnel involved in ship's navigation. Electronic navigation and data systems provide precise fix accuracy that is usually 0.25 NM or less. A thorough understanding of principles of operation and operational use of the various equipment is mandatory. However, basic conventional navigation skills, including celestial navigation and plotting accuracy, must be maintained through training and practice. Individual unit training programs must provide for accurate assessment and training necessary to educate, qualify, evaluate and periodically requalify assigned personnel.

a. Watch Qualification

(1) Navigator. On all ships designated for command by officers in the rank of Lieutenant Commander or junior. The Executive Officer will be assigned in writing to duties as Navigator. Minimum qualifications of the Navigator will be:

(a) For NAVSURFPAC/NAVSURFLANT ships:

1 Qualified OOD underway (If BUPERS assigned, must complete OOD qualifications within 6 months of reporting).

2 Completed Navigator/Senior QM Refresher course (K-2G-2207).

3 Completed Celestial Refresher Course (K-2G-0603).

4 Completed Navigator/Assistant Navigator PQS (NAVEDTRA 43492-2).

5 NAVSTAR GPS AN/WRN-6 Operator Course (K-061-0321).

(b) For NAVAIRPAC/NAVAIRLANT (NON-11XX) (also applies to Assistant Navigator):

1 BUPERS-assigned.

2 Conning Officer qualified.

3 Completed Navigator/Senior QM Refresher course (K-2G-2207).

4 Completed Celestial Navigation Refresher course (K-2G-0603).

5 Completed Tactics and Maneuvering Fundamentals course (K-2G-2708).

6 Completed Advanced Shiphandling (MSI) course.

7 Completed Navigator/Assistant Navigator PQS (NAVEDTRA 43492-2).

(c) Requests for waivers for any of the above requirements will be considered on a case by case basis and will be addressed to ship's Type Commander via the chain of command.

(2) The Senior Quartermaster will complete the following:

(a) Navigator/Senior QM Refresher course (K-26-2207).

(b) Celestial Navigation Refresher course (K-26-0603).

(c) Assistant Navigator PQS qualifications as listed in NAVEDTRA 43492-2.

(d) NAVSTAR GPS AN/WRN-6 Operator Course (K-061-0321).

(3) CIC/CDC Radar Navigation and Bridge Teams will complete Radar Navigation Team Training Course (J-221-0344).

(4) Each Navigation Team Member will complete or be interim qualified in the applicable PQS for assignment to watch stations.

(5) Helm Safety Officers will complete the required NAVEDTRA 43492-2, Watch Station PQS - (Helm/After Steering Helm Safety Officer).

(6) Watch station qualification will provide for a formal method to ensure minimum standards of knowledge are demonstrated for each watch station as detailed in OPNAV PQS Managers Guide and type commander instructions. Qualification books specify areas to be knowledgeable in and require signatures of appropriately designated persons who will certify that minimum standards have been met for a specific area. The final qualification will include an oral and/or written examination and practical demonstration of skills which are certified by the Commanding Officer or his/her designated representative.

(7) Watch station requalification will be required to ensure an adequate level of knowledge is being maintained for all qualified watch standers. Requalification according to OPNAV PQS Manager's Guide, for a Watch station requalification, will be required as follows:

(a) When more than six months have passed since the watch stander has stood the watch.

(b) When changes in procedures or equipment require requalification in the judgment of the Senior Watch Officer, Navigator or Commanding Officer.

(c) When, through poor performance, the watch stander has been disqualified.

6. Purpose. This document provides uniform navigation standards for Atlantic and Pacific surface/air type commanders and comprehensive instruction to achieve and maintain those standards. Organizational relationships, operational procedures, and required basic skills are discussed in depth; minimum standards are established and an extensive navigation bill is provided.

CHAPTER 2

STANDARD NAVIGATION BILL

References: (a) OPNAVINST 3120.32C SORM  
(b) U.S. Navy Regulations  
(c) CNSL/CNSP C3516

1. General. This chapter contains sections of a standard navigation bill that will be tailored for use by the ship's navigation team. It contains minimum standards to serve as the foundation for development of ship's Navigation Bill.

2. Responsibility for the Bill. The Navigator is responsible for maintaining this bill.

3. Duties and responsibilities. With respect to navigation, the following duties and responsibilities exist as stated in references (a) and (b) and amplified below:

a. Commanding Officer. The Commanding Officer is responsible for safe navigation of the ship. As stated in reference (a), "the presence of a pilot on board will not relieve the Commanding Officer or any subordinate from his or her responsibility for the proper performance of the duties with which he or she may be charged concerning the navigation and handling of the ship." Pilots, as advisors to the Commanding Officer and the navigation team, should be familiarized with ship characteristics and planned navigational track prior to beginning the proposed transit. Items for discussion should include:

- (1) Maneuvering characteristics of the ship and lowest depth projection.
- (2) Allowable deviations from charted tracks.
- (3) Unpublished hazards to navigation.
- (4) Bridge-to-Bridge radio communications.
- (5) Ship-specific piloting and conning procedures.
- (6) Use of tugs.
- (7) Material casualties that may impact on ship's maneuverability.
- (8) Material condition of ship (oil leaks, steering systems, etc.).

b. Executive Officer. The Executive Officer, next to the Commanding Officer, is the most experienced officer aboard with respect to navigation and safe shiphandling. The Executive Officer will be readily available to assist the Commanding Officer and Navigator during all restricted water transits. Additionally, the Executive Officer will review the navigation brief and charts for completeness as outlined in Appendix B.

c. Navigator. The Navigator is responsible, under the Commanding Officer, for the safe navigation of the ship. He/she will receive all orders relating to his/her navigational duties directly from the Commanding Officer and will make all reports in connection therewith directly to the Commanding Officer. Additional duties of the Navigator include:

(1) Advising the Commanding Officer and Officer of the Deck as to the ship's movements and, if the ship is running into danger, a safe course to be steered. To this end, he/she will:

(a) Maintain an accurate plot of the ship's position by all available means, including celestial, visual, radar, electronic and other appropriate means. No single source of navigation information will be used to the exclusion of others. Establish a sound liaison between CIC/CDC and NAVPLOT for comparison of navigation information.

(b) Ensure the navigation team obtains ship's position by all available means before getting underway. Fixes from various sources will be compared to determine fix error. When error is considered excessive, the Navigator will investigate and resolve the problem. Conditions permitting, the same procedure will be employed before entering restricted waters.

(c) Give careful attention to the course, speed, and depth of water when approaching land or shoals.

(d) Maintain records of all observations and computations made for the purpose of navigating the ship, with results and dates included. Such records will form a part of the ship's official records.

(e) Report in writing to the Commanding Officer, with copy to embarked staff, when underway, the ship's position at 0800, 1200, and 2000 each day and at such other times as the Commanding Officer may require.

(f) Procure and maintain all navigational charts and publications as directed by the Commanding Officer and higher.

(g) Recommend to the Commanding Officer which ready charts and publications are to be kept continuously up to date.

(h) Ensure records of corrections affecting such charts and publications are maintained.

(i) Ensure that corrections to operational charts and publications are made prior to use, according to directions published in the NIMA Notice To Mariners.

(j) Navigation teams should establish adequate inventory control procedures to ensure required navigation charts and publications are stocked on board in accordance with CINCPACFLT/CINCLANTFLT allowances and that all material is properly maintained and stowed for deployment.

(k) Personally supervise navigation of the ship when the ship is in restricted waters and/or when at battle stations, unless specifically

designated by Commanding Officer to stand another watch. In this case, another officer qualified to serve as Navigator will be directed in writing to perform these duties by the Commanding Officer.

(l) Before entering restricted waters, study all available sources of information concerning navigation of the ship therein.

(m) Prior to anchoring, ensure that the appropriate chart showing the ship's anchorage position and all navigation aids to be used are identified to the Officer of the Deck. Once the determination is made by the Navigator that the anchor is holding, plot swing and drag circles and establish fix intervals according to ship's Navigation Bill.

(n) Prepare for the Commanding Officer's Night Orders in such a format as is prescribed by the Commanding Officer. As a minimum, include operating areas, night steaming instructions, aids to navigation, and fix interval (if other than prescribed in the standing orders).

(o) For nuclear-powered ships, verify that the ship will moor or anchor at an approved berth or anchorage according to OPNAVINST C3000.8 Series.

(2) Operation, care and maintenance of the ship's navigational equipment. To this end, he/she will:

(a) Establish the requirement to conduct and record underway gyro comparisons once daily and before restricted maneuvering situations. Log and report the results to the Commanding Officer. He/she will cause frequent comparisons of the Inertial Navigation System (INS), master gyro, auxiliary gyro and magnetic compass to be made and recorded.

(b) Adjust and compensate the magnetic compass per required PMS and prepare a table of deviations, making sure that copies are posted at the appropriate conning and plotting stations. Ships using digital magnetic compasses (flux gate) are not required to post deviation tables, but will ensure that the digital electronic compass and all remote repeaters are operating within limits specified in the appropriate technical manual. During restricted water transit, the "ADJUST" switch of the FLUX GATE compass will be turned off, and heading displays will ONLY be MAGNETIC COMPASS HEADINGS.

(c) Ensure that the ship's clocks/chronometers are properly maintained and set. Ensure time checks are passed daily throughout the ship and before any special evolution and logged in the Ship's Deck Log.

(d) Commencement and completion of Special Navigation Evolution Checklist (i.e., Underway/Entering Port, Low Visibility, Replenishment at Sea, etc.) must be logged in Ship's Deck Log.

(e) Ensure that the electronic navigational equipment assigned to him/her is kept in proper adjustment and if appropriate, that calibration curves or tables are maintained and checked at prescribed intervals.

(f) Train and practice alternative methods of determining compass

error. NAVPUB 9 "Bowditch" explains numerous methods of determining compass error.

(3) Advise the Chief Engineer and the Commanding Officer of any deficiencies observed in the steering systems and monitor the progress of corrective action.

(4) Ensure the preparation and timely submission of the deck log. He/she will daily, and more often when necessary, inspect the deck log and take such corrective actions as may be necessary and within his/her authority.

(5) Ensure the preparation of such reports and records as are required in connection with his/her navigational duties, including those pertaining to the compasses, hydrography, oceanography, and meteorology are properly maintained.

(6) Ensure the conduct of required navigational training of all personnel, such as junior officers, boat coxswains and boat officers; the training of all quarterdeck personnel in the procedures for honors and ceremonies; and of all junior officers in Navy etiquette.

(7) Normally responsible for honors and ceremonies and other special occasions.

(8) Relieve the Officer of the Deck, as authorized or directed by the Commanding Officer.

The Navigator reports to the Commanding Officer in all matters about the navigation of the ship, and to the Executive Officer in matters about the administration of the navigation department and the training of deck and watch officers. (He/she may report to the Senior Watch Officer for the training of deck and watch officers in navigation.)

d. The Assistant Navigator. The Assistant Navigator will assist the Navigator in all aspects of navigation, piloting and administration of the navigation department. He/she will ensure proper preparation of the various reports required by higher authority.

4. Organization of the Navigation Team. In addition to the Commanding Officer, Executive Officer and Navigator, there are several other key members of the navigation team. These include the Tactical Action Officer, Officer of the Deck and CIC/CDC Watch Officer. Listed below are key members of the navigation team.

a. Navigation (Bridge) Team

(1) Navigation Evaluator. If not the Navigator, this person is responsible to the Navigator for evaluating fix accuracy from bridge and CIC/CDC and making fix reports as specified in this instruction. He/she supervises and coordinates the actions of all bridge navigation team members. This individual must have completed qualifications as prescribed for the senior QM in chapter 1.

(2) Navigation Plotter. Maintains the Navigation plot. He/she will plot and label each fix on the chart in use. He/she will extend the dead reckoning at least two fix intervals, compute set and drift since last fix and evaluate ship's projected movements. He/she will make recommendations to the Navigator/Navigation Evaluator. He/she will compute such items as time and distance to the next course change, revised turning bearings and any other tasks directed by the Navigator/Navigation Evaluator. Navigation Plotter will plot and compare WRN-6 (GPS) fix data on every third fix.

(3) Bearing Recorder. Acts as the Navigator's talker on the designated sound-powered telephone circuit, relays information received to the Navigator, maintains the Standard Bearing Book (OPNAV Form 3530/3) according to current directives and may give "marks" to the bearing takers, as directed by the Navigator/Navigation Evaluator. In addition, Bearing Recorder will log WRN-6 (GPS) data at every mark in the Bearing Book and/or Position Record Book.

(4) Bearing Takers. Obtain accurate bearings to navigation aids designated by the Navigator. Advises the Navigator about navigation aids available for use, including the gaining and losing of navigation aids from sight. They will keep the aids in sight between shots. Additionally, they will know the location and use of pelorus bench marks.

(5) Leadsman. If used, his/her soundings will be sent over the maneuvering and docking circuit to the bridge. This information is usually desired by the Captain and the Officer of the Deck, as well as the Navigator.

(6) Navigation Radar Operator. Provide all radar data as directed by the Navigator.

(7) Fathometer Operator. Operates the fathometer on a scale designated by the Navigator. Advises the Navigator whenever the scale is shifted and reports soundings to the Bearing Recorder. The minimum sounding expected should be known and reported if reached. The Navigator must be advised if difficulty is experienced obtaining a sounding.

(8) Quartermaster of the Watch. Maintains the Ship's Deck Log, magnetic compass record, and weather observation sheet in addition to those duties which are prescribed in other navigation department instructions.

b. CIC/CDC Navigation Team

(1) Piloting Officer. Evaluates fix accuracy. Maintains direct communications with Shipping Officer and Bridge Phone Talker. Keeps the Shipping Officer advised of impending course/speed changes to determine which contacts should be tracked. Supervises the Navigation Radar Operator, Navigation Plotter, and Navigation Recorder. Responsible for providing an effective flow of navigational information and recommendations to the Navigator.

(2) Shipping Officer. Maintains direct communications with Piloting Officer and Bridge Phone Talker. Responsible for providing to the Conning Officer the evaluated surface display. Supervises and coordinates the



CIC/CDC Radar Detection Team and the Lookouts. He/she will recommend proper actions to be taken according to the Rules of the Road. Additionally, ensures a record of all surface contacts encountered are logged and/or recorded.

(3) Navigation Radar Operator. Provides all radar ranges as directed by the Navigation Plotter. Maintains communications with the Navigation Plotter, keeping him/her informed of designated points available for use.

(4) Navigation Plotter. Maintains CIC/CDC's navigation plot. He/she will plot and label each fix on the chart in use. He/she will extend the DR at least two fix intervals, compute set and drift since last fix and evaluate ship's projected movements. He/she will compute such items as time and distance to the next course change, revised turning ranges and any other tasks directed by the Piloting Officer. He/she will make recommendations to the Piloting Officer.

(5) Navigation Recorder. Performs as a phone talker and monitors the Bridge Bearing Recorder and Fathometer Operator. Calls the "mark" for the CIC/CDC Plotting Team and maintains the CIC/CDC Navigation Log to coincide with bridge Bearing Recorder "mark".

(6) Bridge CIC/CDC Phone Talker. Provides smooth flow of navigation information to Navigator, the CIC/CDC Piloting Officer, and Shipping Officer.

5. Navigation Team duties before entering restricted waters. In addition to the Commanding Officer, Navigator, and Officer of the Deck, whose duties are covered elsewhere, the duties of the Navigation and CIC/CDC Teams are as follows.

a. The Navigator is charged with preparing a Navigation Brief as a plan for safe and prudent passage, including piloting. This plan will be reviewed and approved by the Commanding Officer. Keep the approved plan on file as required, but no less than 6 months. In preparing this plan, use Appendix B, and consider the following:

(1) Consult Sailing Directions, Coast Pilots, Fleet Guides, Port Directories, and other navigational publications, as appropriate. All references must be current editions and corrected to date.

(2) Charts to be used are corrected using all available information and all area charts are compared to ensure that hazards to navigation are properly displayed and highlighted on all charts in use. Navigation charts will be selected from the optimum scale chart available.

(a) Verify the geodetic system on which the chart is based. Satellite systems set to use WGS-84 or other chart referenced datum, will apply factored corrections from the charts. Satellite receivers which support various datum's, will be adjusted to the appropriate datum referenced, e.g. TOKYO DATUM, etc.

(3) The ship's proposed track and navigation information are laid down identically, on all charts used for navigation, including those used in

CIC/CDC navigation plot. On all tracks, the following items should be accurately plotted or indicated:

(a) The course (true and magnetic), speed, distances of each track leg, and distances remaining to the turn.

(b) Danger bearings and ranges to navigation hazards not marked by navigation aids.

(c) Turn bearings in true and relative; turn ranges (in yards) and slide bars will be plotted allowing for the ship's advance and transfer tactical data.

(d) A statement for each turn stating "Turn based on \_\_\_\_ knots and \_\_\_\_ rudder" combination.

(e) Bridge and CIC/CDC will indicate chart shift points so that both are not shifted at the same time and so that they do not require shifting during, or at the time of, an impending turn. The Bridge or CIC/CDC will have a good fix plotted before the next station shifts charts.

(f) Extended range scale will be placed on chart to facilitate laying of radar ranges or distances.

(4) Restricted water track charts will be reviewed independently, by the SQM or a second person, for accuracy and corrections and provided to the Navigator for review and submission to the Commanding Officer for approval.

(5) Sound signal characteristics of all navigational aids will be determined and specific characteristics labeled on the chart next to each nauid the ship will pass, if not printed on chart.

(6) Restricted water track charts are annotated for shoal water, points of hazards or dangers including overhead obstructions, with danger bearings or ranges laid out for hazards (which are unmarked by a navigational aid).

(7) Indicate position along the track where the PIT SWORD will be raised and/or lowered.

(8) Determine with concurrence of the Commanding Officer when the Engineering Restricted Maneuvering Doctrine will be initiated.

(9) Charts will be reviewed, signed, and dated, before use. At a minimum, the following will appear on the bottom left hand corner of the open chart for each restricted water track chart.

\_\_\_\_ Prepared by:  
\_\_\_\_ Submitted by: (NAV)  
\_\_\_\_ Approved by: (CO)

(10) Tide and currents will be determined for each reference station passed. Sub-stations along the track should be used where tides and currents are critical to the shiphandler, however, the number of sub-stations will be

determined by the Navigator and will be marked on the charts.

(a) Graph tides using the "Quarter Tenth" method as described in the Tide tables. Graph currents using the straight line method based on slack, high and low water ratios. Record all tide and current computations in the navigation workbook. Post all graphs at all ship control stations as described in Appendix B. The Commanding Officer may authorize a computer program for computing tides and currents. A copy of such graphs will be maintained for 6 months.

(11) In every instance the Navigator will brief all members of ship control stations before getting underway or entering port and restricted waters transits. This briefing will conform to Appendix B.

b. The Navigator will ensure that the following are accomplished:

(1) All navigation equipment is on board, calibrated, and operating properly and that navigation pre-underway or entering port checks are completed according to the ship's standard operating procedures, navigation department check-off lists, and individual equipment operating procedures. He/she will also review the status of equipment. Estimated Time of Repair (ETR) will be provided by the EMO or Electrical Officer, as appropriate.

(2) Gyro errors are to be determined frequently, at least daily underway. Master gyro and repeater errors are determined before getting underway or entering restricted waters and are checked against available navigational ranges. Changes to gyro error are entered in Bearing Record Books and Magnetic Compass Record Book and applied to all fixes by the Navigation Plotter. Gyro error and repeater error must also be updated on all repeater placards.

6. Navigation team duties while in restricted waters. Employ the following procedures while underway in restricted waters:

a. The Navigator's plot is designated as the primary navigation plot. Navigation information maintained in CIC/CDC, designated as the secondary navigation plot, will supplement the navigator's plot. The Commanding Officer may authorize a shift in the location of the primary plot to suit a particular situation. The navigation team should adhere, in so far as possible, to the following fundamental piloting principle: an optimum balance between accuracy and speed must be achieved while piloting. When operating in close proximity to shoals or hazards, accurate present and projected ship position information is required. In addition, such fix information must be updated as necessary to provide timely warning if the ship is standing into danger. This is particularly true when in restricted waters. The Navigator will always utilize at least three LOPs for each fix.

b. The Navigator will ensure:

(1) The ship's position is fixed at an interval that ensures safe navigation, (recommended intervals are listed in Table 2-A). The interval between fixes may be adjusted by the Navigator as a function of water depth, current, bottom contour, ship's draft and track, assessed position accuracy,

width of channel and other factors.

(2) Set and drift are accurately determined and logged in the Ship's Deck Log. Set and drift will be determined on each leg less than 1000 yards and every third fix for legs greater than 1000 yards. Set and drift should be computed more often if conditions dictate. If required fixes cannot be obtained, apply set and drift to the DR to obtain an EP.

(3) Every fix has a DR track properly labeled with course, speed, and times projected far enough ahead to include DR positions for at least the next two fix intervals, including beyond any turns encountered.

(4) Turn points are based on bearings plotted on the chart; course changes take into consideration advance and transfer, set and drift, and slide bar.

(5) The DR track of the recommended course is clear of navigation hazards, and does not endanger the ship.

(6) A fix is taken as soon as the ship is steady on the new course. Notify the Commanding Officer when a "no fix" situation arises (Commanding Officer will verbally acknowledge; i.e. "Very Well". Attempt another fix immediately. Adhere to prudent navigation practices for the existing circumstances until the ship's position is accurately determined.

(7) Fixes are obtained from fixed aids to navigation and charted structures rather than buoys, whenever possible. When buoy positions are verified, bearings to buoys may be used to help clarify the navigation picture when no other objects are available. However, the Navigator must be circumspect in his/her use of such information.

(8) A fix is not erased because it appears in error; take another fix immediately to learn the ship's position, followed by a second fix after 1 minute. Make recommendation to slow down, turn away from danger, or stop the ship until an accurate fix is obtained.

(9) Positions and fixes are verified by all available means, including: visual, soundings, buoys, radar, INS, electronic aids and ECDIS-N displays.

(10) The fathometer is energized and recording whenever in restricted waters or in waters less than 100 fathoms. Whenever possible, the fathometer will be set to coincide with the depth scale of the chart being used. Whenever soundings are less than the minimum designated values, notify the Navigator immediately. Compare soundings with charted depths on each fix and report to the OOD. Log all soundings in the Standard Bearing Book and Ship's Position Log.

(11) Accurate records and logs are kept. Complete reconstruction of the ship's track must be possible at any time. Replotting of logged data at a later date provides a good evaluation of the navigation team's proficiency and can be an excellent training aid.

(12) The use of checklists in routine navigation (i.e., low

visibility, entering/leaving port, swept channel, etc.). Keep these checklists for 6 months after completion of the evolution. (See Appendix C)

c. The Navigation Evaluator will ensure that every fix determined from the primary navigation plot (Bridge) is compared to the fix obtained at the secondary plot (CIC/CDC). In addition, the phrase "CIC/CDC concurs," "CIC/CDC does not concur," or "CIC/CDC has no fix," with appropriate amplifying information, will be included in every verbal position report made by the Navigation Evaluator to the Navigator, Conning Officer, and Commanding Officer. The Navigation Evaluator will acknowledge the CIC/CDC report. The format for this report will include the following information for each fix:

- (1) Fix time.
- (2) Fix/EP Quality (excellent, good, poor, etc.).
- (3) Fix method if other than primary means (i.e., Bridge visual, CIC/CDC radar, etc.).
- (4) Fix position in relation to proposed track.
- (5) Nearest hazard to navigation.
- (6) Nearest Aid to Navigation.
- (7) Corrected Fathometer sounding, and comparison to charted depth.
- (8) Distance and time to next turn.
- (9) Course on next turn (reported at least once each leg and updated as changes occur).
- (10) Any recommendation to regain/maintain proposed track.
- (11) Report computed set and drift (once on each leg when less than 1000 yards and every third fix for legs greater than 1000 yards).
- (12) The phrase "CIC/CDC concurs," "CIC/CDC does not concur," or "CIC/CDC has no fix."

d. The Navigation Evaluator will compare CIC/CDC reported navigation information with Bridge Navigation information at every fix.

e. The Conning Officer or Officer of the Deck will acknowledge the Navigation Evaluator's report.

f. The Conning Officer or Officer of the Deck and Commanding Officer will verbally acknowledge all "no fix" and/or "non-concurrence" reports.

g. The Commanding Officer will verbally acknowledge all non-concurrences between Conning Officer and the Navigator (i.e., shipping traffic, etc.).

h. The Piloting Officer will report to the Navigator all navigation fix

information derived by radar or any other source at each fix. The format for this report should include the following information for each fix:

- (1) Fix time.
- (2) Fix/EP Quality (excellent, good, poor, etc.).
- (3) Fix method, if other than primary means (i.e., Bridge visual, CIC/CDC radar, etc.).
- (4) Fix position in relation to proposed track.
- (5) Nearest hazard to navigation.
- (6) Nearest Aid to Navigation.
- (7) Corrected Fathometer sounding, and comparison to charted depth.
- (8) Distance and time to next turn.
- (9) Course on next turn (reported each leg and updated as changes occur).
- (10) Any recommendation to regain/maintain proposed track.

(11) Report computed set and drift (once on each leg when less than 1000 yards and every third fix for legs greater than 1000 yards).

(i) The Shipping Officer will report to the Navigation Evaluator/Conning Officer all critical shipping and bearing "clear/foul", with appropriate avoidance recommendation, for all course changes and intended maneuvers.

7. Navigational practices while in the open ocean. In the open ocean, use the following guidelines for obtaining an accurate fix by both primary and secondary plots.

a. Compare navigation data from multiple sources, such as electronic NAVAIDS, radar, and celestial sources according to Chapter 3, Section 5.

(1) If comparisons indicate excessive differences, determine the source of excessive differences from resultant best fixes and analyze them to determine the cause.

(2) The Inertial Navigation System (INS) will only be reset at the direction of the Navigator or Commanding Officer. Check the error and magnitude of the reset before the reset is entered. When resetting, record the resets according to the instructions for maintaining the Ship's Position Log.

b. Fix the ship's position at least half-hourly, when possible, assuring that fix data is used from all available sources.

c. Maintain a DR track extending from the fix through the next two (2) fix intervals.

d. Set and drift will be computed and logged in the Ship's Deck Log each time the ship's position is fixed. A recommended course to compensate for set and drift will be given by the Navigator or the Quartermaster of the Watch.

e. Except when directed by the Commanding Officer, a sounding will be taken with every fix.

(1) Compare soundings to the ship's charted depth.

(2) Log soundings in the Ship's Position Log and/or the Standard Bearing Book.

f. Report and compare the ship's position, hourly, to navigation information users, such as CIC/CDC.

g. If weather permits, take an azimuth/amplitude of the sun or other celestial body at least twice daily to determine gyro error.

h. Weather permitting, minimum daily celestial activity will conform as closely as possible to Appendix D. Times for accomplishing these elements are not defined, due to variations in the times of celestial observations.

i. Minimum accuracy standards for fixing the ship's position and the interval between these fixes are, to some extent, situation dependent. **Table 2-A** summarizes the orders of accuracies and recommended fix intervals prescribed.

j. Make Deck Log and Weather Log entries for any significant change in weather.

8. QMOW duties while in the open sea. The Quartermaster of the Watch is the direct representative of the Navigator. He/she will assist the Navigator and Officer of the Deck in navigating the ship and will immediately inform the Navigator, Officer of the Deck, Assistant Navigator and Senior Quartermaster when discrepancies arise. This instruction is not to be construed to limit the QMOW in the exercise of his/her best professional judgment in assessing small discrepancies and advising the personnel cited above.

a. The QMOW represents a continuous navigational watch on the bridge. He/she is the primary assistant to the OOD for navigation and recording all events affecting the ship and its crew.

b. The QMOW has numerous duties, including the keeping of various records, logs, weather observations, and obtaining fix information. The OOD must recognize this and if fix taking encumbers the QMOW from performing all other duties, the Senior Quartermaster, Assistant Navigator and Navigator will be informed so as to provide additional assistance to the QMOW.

c. This instruction cannot possibly cover all situations that may arise during the QMOW's watch; however, he/she is charged with the following minimum responsibilities:

(1) Assist the OOD, Navigator, and Assistant Navigator in plotting the ship's position at least every 30 minutes. Maintain a DR and estimated position plot. Makes sure all course and speed changes ordered by OOD are logged. Immediately notify the Navigator of any discrepancies noted during the watch.

(2) At least every 60 minutes, compare CIC/CDC NTDS derived positions with the bridge navigation plotted position and determine if errors exist.

(3) Compute and plot set and drift at every fix and record the data in the Ship's Deck Log.

(4) Calculate when an aid to navigation or radar landfall is expected to be sighted and report whether or not it is detected as specified in the Commanding Officer's standing orders.

(5) Note when a change in weather or the visibility decreases to less than the distance specified in the Commanding Officer's standing orders. Make appropriate log entries as required.

(6) Determine the INS and master/auxiliary gyro compass errors, recording any errors in the Bearing Book, Magnetic Compass Record Book, and Deck Log.

(7) Ensure compass comparisons between the bridge gyro repeaters and magnetic compass are made every time a new course is set and at least every 30 minutes and recorded in the Magnetic Compass Record Book.

(8) Note any malfunctions to all electronic navigation systems including speed and heading inputs. Inform the Navigator and Officer of the Deck of any change in the status of such equipment and log in the Ship's Deck Log the time and nature of such occurrence.

(9) Obtain soundings using the fathometer at each fix, or as directed by the Commanding Officer, EMCON conditions permitting.

(10) Perform celestial observations according to Appendix D. Record results in the Navigation Workbook, Position Record Book, and Magnetic Compass Record Book. When using the STELLA, computer software, documentation of all observations must be maintained in a loose leaf binder.

(11) Prepare the ship's 0800, 1200 and 2000 Ship's Position Report for submission to the Navigator.

(12) Prepare notes for Commanding Officer's Night Orders notebook.

(13) At least daily and before special evolutions, ensure time checks are conducted over all 1MC circuits and logged in the Ship's Deck Log.

(14) Ensure chronometers are compared (and wound if required) daily.

(15) Monitor the Helmsman/Lee Helmsman for compliance with ordered course and speed.



(16) Conduct a watch turnover using a checklist such as that detailed in Appendix E.

9. Fathometer readiness. There are two basic types of fathometers currently in use. The UQN-1, which has no provision for entering a correction factor for keel reference, and the UQN-4, which has the capability of entering a correction factor of up to 10 feet. The UQN-4 with EC-8 installed has the capability of entering a correction factor of up to 99 feet. Technical manuals for both establish the transducer as zero depth reference point. To ensure actual water depth below lowest hull projection, apply the following guidelines:

a. For UQN-1 equipped ships, affix the following label plate to the fathometer (\* depth determined for each class and inscribed):

TO OBTAIN WATER DEPTH BELOW DEEPEST  
PROJECTION, SUBTRACT \_\_\_\_\*\_\_\_\_ FEET  
FROM ALL FATHOMETER SOUNDINGS.  
RESULTING FIGURE IS REPORTED AS  
"CORRECTED FATHOMETER SOUNDING."

b. For UQN-4 equipped ships without EC-8 capability, affix the following label plate to the fathometer and each remote repeater (\* depth determined for each class and inscribed):

TO OBTAIN WATER DEPTH BELOW DEEPEST  
PROJECTION, KEEL REFERENCE SWITCH  
MUST BE SET TO ZERO (10 FEET) AND  
SUBTRACT \_\_\_\_\*\_\_\_\_ FEET. SOUNDING  
IS THEN REPORTED AS "CORRECTED  
FATHOMETER SOUNDING."

c. For UQN-4 equipped ships with EC-8 capability, affix the following label plate to the fathometer and each remote repeater (\* depth determined for each class and inscribed):

TO OBTAIN WATER DEPTH BELOW DEEPEST  
PROJECTION, KEEL REFERENCE SWITCH  
MUST BE SET TO \_\_\_\_\*\_\_\_\_ FEET.  
SOUNDING IS THEN REPORTED AS  
"CORRECTED FATHOMETER SOUNDING."

d. In ships where vertical relationship between the fathometer transducer face and deepest projection varies only slightly throughout the normal range of loading characteristics and trim of the ship, determine a single correction factor to apply to fathometer soundings. The correction factor will be decided by calculating the vertical difference between the transducer face and lowest projection at that extreme of normal trim which maximizes the vertical difference. Additionally, a nomogram will be developed to learn the depth of the transducer face given fore and aft draft and transducer position. Adding this depth to the uncorrected fathometer sounding results in the depth of the water and can be compared with indicated

chart depth.

e. In ships where the vertical relationship between the transducer face and deepest projection varies widely because of loading characteristics or vessels trim, a single correction factor is not practical. Therefore, a correction factor must be calculated for the load which exist at the time the fathometer is in operation. A nomogram incorporating draft forward and aft will be developed to decide the vertical correction. The location of the transducer will be on the nomogram. A label similar to that recommended for UQN-1 ships will be used with a provision for filling in the correction and the time/date the factor was calculated using a grease pencil. The nomogram will be used to learn the depth of the transducer face given the fore and aft draft. Adding this depth to the uncorrected fathometer sounding results in the depth of water and can be compared with indicated chart depth.

f. Standard fathometer sounding reporting procedures require the fathometer operator to report corrected fathometer soundings which will be understood by all concerned to be the depth of water below the deepest projection of the ship. ***To compare fathometer reading to charted depth, add ships draft to corrected fathometer sounding***

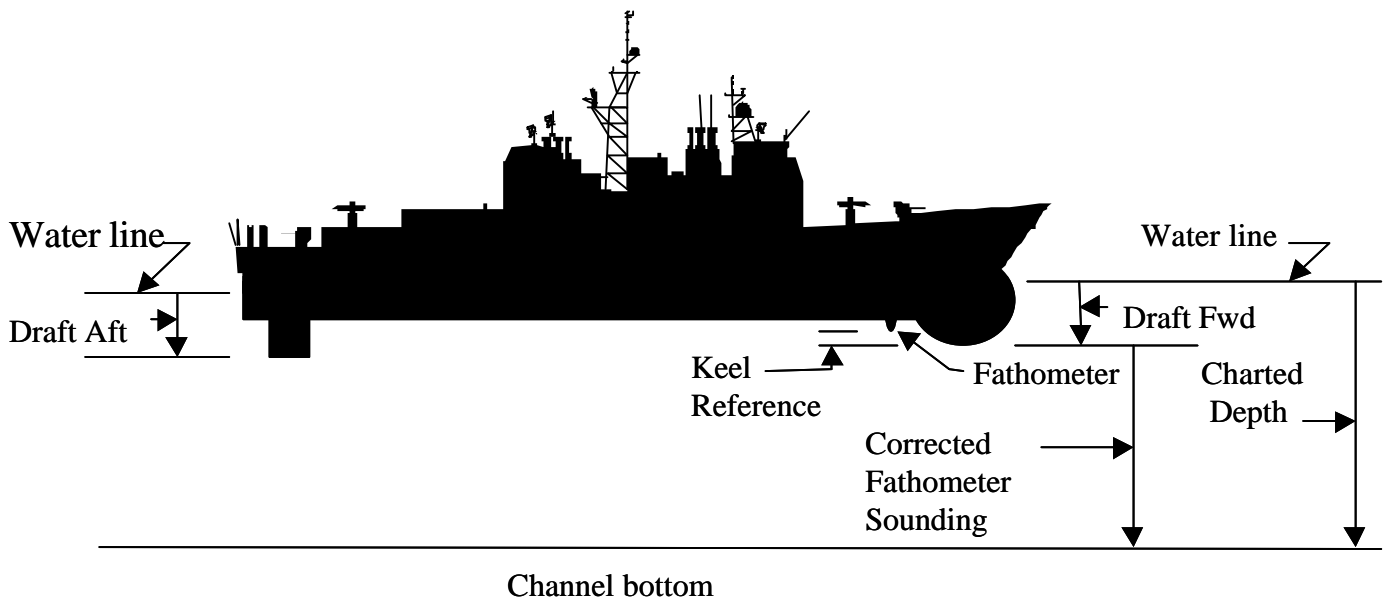


Table 2-A  
SUMMARY OF FIX ACCURACIES AND INTERVALS

AREA	DISTANCE FROM NEAREST LAND	ACCURACY	REQUIRED INTERVAL **
Restricted Waters*	Less than 2 nautical miles	50 yards	2 minutes
Piloting Waters	2-10 nautical miles	100 yards	3-15 minutes as conditions warrant
Coastal Waters	10-30 nautical miles	500 yards	15 minutes
En Route Navigation	Over 30 nautical miles	.75 nm	As conditions warrant, but not greater than 30 minutes

Minimum accuracy standards for fixing the ship's position and the interval between these fixes are, to some extent, situation dependent. Table 2-A summarizes fix accuracy and fix interval guidelines.

\* Restricted waters are defined in each ship's Commanding Officer's Standing Orders and may be different for each class of ship.

\*\* A good rule of thumb for fix intervals is, "if hazard to navigation falls within a circle whose radius is that of two DR intervals", then either the fix interval or ship's speed requires adjusting.

CHAPTER 3

BASIC SKILLS

1. General. This chapter provides guidance on basic skills which serve as the basis for development of each ship's routine.

2. Policy. When at sea, the Officer of the Deck will keep himself/herself informed of the position of the ship and all other particulars which may be used to keep the ship out of danger. He/she will employ all means available for detecting and avoiding danger. The Junior Officer of the Deck, QMOW and other watch standers responsible to the OOD, should never hesitate to request additional watch personnel or recommend stationing the full navigation team if a situation warrants. The following procedures constitute the basis for the navigation teams performance and will be accomplished continuously while the ship is underway by both the bridge and CIC/CDC navigation plots.

3. Dead reckoning (DR) procedures. The DR plot is the most under used source of navigation information. It is a projection of the ship's intended movement from the last fix. DR position accuracy is directly related to the attention given to the maintenance of the DR plot between fixes. Various factors affect the accuracy of the DR. The navigation team must rely upon DR as the foundation for maintaining an acceptable estimate of the ship's position between fixes. It also aids in resolving data source conflicts.

a. The following are general rules used in constructing and maintaining the Navigator's Dead Reckoning plot:

- (1) Plot a DR position at least every hour on the hour.
- (2) Plot a DR position at every course change.
- (3) Plot a DR position at every speed change.
- (4) Plot a DR position when obtaining a fix or running fix.
- (5) Plot a DR position when obtaining a single line of position.

(6) Plot and label with course, speed, and time a new course line from each fix or running fix, as soon as it has been determined and plotted on the chart. This is accomplished whether the ship is on track or not.

- (7) Plot the DR on the optimum scale chart.

b. When using a geographic position table (i.e., DRT, DDRT, etc.), ensure that position inputs or updates are provided from an accurate fix.

c. Ensure that all speed changes are entered as they are ordered when accepting speed data from dummy log.

4. Estimated position procedures

a. When insufficient data is present to accurately fix the position of

the vessel, an Estimated Position may be generated by combining incomplete data at hand from a variety of sources. The Estimated Position may combine the DR position with a single line of bearing, account for set and drift, compensate for tactical data, or represent a combination of these and other factors. Since DR positions are plotted for ordered courses and speed and do not compensate for known values or tactical characteristics of the ship, their relationship to the geodetic position may not always be accurate. To reduce the magnitude of error between the ship's DR position and the geodetic position, the DR plot must be refined during the interval between fixes with a plot of Estimated Positions.

b. To produce an Estimated Position the following guidelines are recommended:

- (1) Use the largest scale chart to enhance the plotting accuracy.
- (2) Include the last DR position in any calculation leading to an estimate of the ship's position.
- (3) Combine all available lines of position of questionable quality with DR position data in the absence of a fix.
- (4) Determine set and drift and apply this data to current work on the Navigator's plot. For ships equipped with GPS, set and drift should be derived from differences in expected and actual positions.
- (5) During high speed maneuvering, compensate for tactical characteristics, interpolating for other than listed speed and rudder angles.
- (6) Use bottom contour charts and the fathometer, when appropriate, to fix ship's position.

5. Integrated navigation. The accuracy of navigation depends on a knowledgeable assessment of all position data. Each source and fix technique is subject to some error. The prudent navigator, therefore, must assess each position determination and evaluate it with respect to all others. The Navigator will ensure this procedure is accomplished at least once every 4 hours or more often as desired. The QMOW and CIC/CDC watch team will plot all fixes on the chart in use at their respective navigation plots.

a. Use of all available resources. Evaluating from all electronic aids, celestial, visual and DR/EP computations provides the basis for knowledgeable evaluation of the ship's position. Each source of fix is subject to some degree of error and accuracy. The navigation team must understand the amount of position error that each fix source is subject to and apply that knowledge, combining multiple sources to obtain the best position. This type of application will also be useful in identifying a fix source that has a significant error. By integrating as many sources of fix information as is reasonably possible, mutually supportive fixes will improve position accuracy and raise the confidence in data produced. The integration of all Navigation Systems to derive a most probable position involves:

- (1) Understanding those factors influencing the day to day or

seasonal variation and effectiveness.

(2) Precise data collection, plotting and analysis at the precise time set for fixing the ship's position.

(3) The navigator's experience, judgment and confidence. The decision to select a single source of positioning data or an averaging approach is based on his/her analysis of the factors which influence Navigation Systems accuracy and the time available to gather and analyze the data.

b. Navigation Sensor System Interface (NAVSSI) is a system available on board some vessels which utilize all available navigation sensors to determine Position, Velocity and Time (PVT) of the ship.

c. Standard Procedures. The Navigator and Quartermaster must:

(1) Properly maintain the ship's DR, including a running E.P. plot.

(2) Use the DR and all available fixes to a composite fix.

(3) Note variation in fix clusters in successive plots, and remain alert to the first indication of accuracy degradation in their data.

(4) Flag all geodetic positioning data provided to the users of navigation information, with an assessment of fix quality (excellent, good or poor).

(5) Maintain close communication with the TAO to:

(a) Ensure that the NTDS/ACDS DR position is frequently updated to reflect the fix from the Navigator's plot. (For NTDS ships only)

(b) Be alert to the quality of the fix in his/her tactical evaluation to reduce errors in tactical warfare situations.

(c) Ensure system updates and GPS almanac data is provided to Tomahawk Engagement Planning Exercise and Evaluation (TEPEE) console prior to their deployment as prescribed in the Commanding Officer's Battle Bill.

(6) Ensure that any position data the TAO receives from the Navigator is compared with the current display. Any that do not constitute a logical extension of previous fixes, and Estimated Position in relation to time, are brought to the attention of the Navigator and CIC/CDC watch supervisor to coordinate a resolution of the error. (The Navigator will provide final verification and correction, if required.)

## CHAPTER 4

### RECORDS, LOGS AND FORMS

1. Purpose. The importance of keeping complete, concise and accurate navigation records, logs and forms cannot be overemphasized. Besides providing the recorded history of the ship, they become a basis for analysis and evaluation, and correction of material, operational, and personnel deficiencies in warfare. Should it ever become necessary, they comprise the legal records examined by courts of inquiry and official investigation.

2. Corrections. Erasures are strictly forbidden in all navigation logs and records except the Navigation Workbook. Corrections are only made by neatly lining out and initialing an entry. Ball-point pen with non-water soluble black ink will be used throughout, except in the Navigation Workbook in which pencil is authorized for recording and computations.

#### 3. Ship's Deck Log

a. Purpose. The deck log will be a complete daily record, by watches, in which will be described every circumstance and occurrence of importance or interest which concerns the crew, and the operation and safety of the ship or which may be of historical value. When underway, the OOD and QMOW will review the deck log from the last watch they stood before relieving.

b. Instructions for Maintenance. The deck log will be kept according to OPNAVINST 3100.7B. A copy of this instruction will be placed in the front of the log, if not provided by preprinted format. The following entries, in addition to those required by OPNAVINST 3100.7B will be included as appropriate:

(1) Draft (forward, aft, mean) and displacement.

(2) Set and Drift (when determined).

(3) Time Checks.

(4) Commencement and Completion of all Special Evolutions and the completion of any Check Lists.

c. Responsibility for Review and Approval. The Navigator will review the Deck Log daily and submit the record to the Commanding Officer at the end of the month for his/her signature.

d. Retention. The original Deck Log will be forwarded to the Naval Historical Center no later than the tenth (10th) day of each month. Duplicate Deck Logs will be kept on board for 1 year.

#### 4. Ship Position Log (OPNAV Form 3100/3) (6-76)

a. Purpose. A Ship Position Log will be a record of positions and soundings from all sources used. In addition, DR positions, set and drift and manual resets of SINS, NTDS, DRAI, etc., will be recorded. In light of

different ship configurations and mission, specific codes to indicate type of fixes will be determined by the Navigator and included in the log.

b. Instructions for Maintenance. Whenever a fix is determined and at least every half-hour, a position from all available sources will be recorded. The Navigator may limit this to once every 30 minutes if frequent fixes are obtained.

(1) A sounding will be obtained and recorded in the remarks column with each fix.

(2) The Ship Position Log may be secured with the concurrence of the Navigator or Assistant Navigator whenever the Standard Bearing Book is used in piloting waters. When entering restricted waters from the open sea, the initial piloting fix will be recorded in both the Ship's Position Log and Standard Bearing Book. The same is true of the last piloting fix when leaving restricted waters. Upon relief or when secured, the watch or Bearing Recorder will sign his/her name across columns 18-41.

c. Responsibility. The Ship Position Log will be kept during coastal and open ocean navigation by both bridge and CIC/CDC watch standers.

d. Retention. This log will be kept for 3 years after the date of the final entry.

5. Navigation Workbook (OPNAV Form 3530/1)

a. Purpose. The Navigation Workbook is the record of all observations and computations used for navigation of the ship. This will include data relating to celestial lines of position, tides and currents, sunrise/sunset, moonrise/moonset, and gyro error.

b. Instructions for Maintenance. The Navigation Workbook will be kept according to OPNAVINST 3530.3B. The Navigator is responsible for proper maintenance of this log. In view of the large amount of data which may be recorded, ships may organize data into separate notebooks as directed by the Commanding Officer. Locally prepared strip forms will be affixed to or recorded in the workbook. If calculators are used, enough data must be recorded in the workbook to reconstruct the computation. When using STELLA, documentation of work must be maintained in a loose leaf binder.

c. Responsibility for Review and Approval. The Navigator will review and sign the workbook daily.

d. Retention. This record will be kept 3 years from the last entry.

6. Standard Bearing Book (OPNAV Form 3520/2)

a. Purpose. The Standard Bearing Book is a record of the data obtained to determine the ship's position by visual bearings, sextant angles, radar bearings, and/or radar ranges.

b. Instructions for Maintenance. It will be kept according to OPNAVINST



3530.3B with the following modifications:

(1) Record the chart number in use at the top of the initial page each day. Each shift of charts will be noted in the first available blank line of the log.

(2) The time zone and date will be indicated.

(3) Label radar ranges YD (yards) or NM (Nautical Miles). Label stadimeter ranges "STAD."

(4) Soundings will be in column 7 at the time each fix is obtained and labeled FT (feet) or FM (fathoms).

(5) All bearings are true, unless otherwise indicated by R (relative) or M (magnetic) for helmsman's heading. When during loss of gyro and shifting to R (relative), the shift will be noted on the first available blank line of the log.

(6) All abbreviations must be according to Chart No. 1, "Nautical Chart Symbols and Abbreviations."

(7) Record the current gyro error and gyro repeater errors on all Polaris' and at the top of the initial page each day. Any revised gyro error will be noted in the first available blank line of the log. Enter the radar bearing error and/or heading error(s) at the top of the initial page each day.

(8) A list of NAVAIDS must be permanently maintained in the book and will include the abbreviation, noun name and lat/long. (Visual NAVAIDS such as tank, tower will have alphanumeric designation. Other NAVAIDS such as fixed lights, Point Loma, Chesapeake light need not be alphanumerically designated.)

c. Responsibility. The Standard Bearing Book will be signed after the last entry on the next available line, by the Bearing Recorder, at the end of his/her watch or navigation detail.

d. Retention. The Standard Bearing Book will be kept on board for 3 years after the date of the last entry as part of the ship's official records.

## 7. Chart/Publication Correction Files

a. Purpose. A record of all corrections for the current allowance of NIMA charts and publications established by the current edition of the Nautical Chart and Publication Allowance.

b. Instructions for maintenance. Chart/Publication Correction Cards (DMAHC 8660/9) will be on board and maintained according to the instructions in NIMA Catalog of Maps, Charts and Related Products - Part 2 Hydrographic products requisitioning procedures.

(1) The Chart Petty Officer will enter corrections to the chart

cards. The Publication Petty Officer will enter corrections to the publication cards. However, the QMOW is responsible to enter all corrections to charts and publications required for current use. Local area charts and those portfolios designated by the Commanding Officer will be maintained up-to-date at all times. Corrections for all other charts or publications will be indexed and these changes entered before using chart or publications. Those publications designated by the Commanding Officer will be kept current at all times.

c. Responsibility for review and approval. The department Senior Quartermaster is responsible for reviewing the ship's charts, publications, and correction files to ensure their proper maintenance. During audits, he/she will ensure that applicable allowance lists, NIMA R05 lists, lists of effective corrections are reviewed during the inventory.

d. Retention. Correction cards will be kept up-to-date for all charts and publications on board. When a chart or publication is superseded, destroy the old card, and replace it with a new card.

#### 8. Notice to Mariners/Summary of Corrections

a. Purpose. Notices to Mariners, Summary of Corrections, and use of the Automated Notice to Mariners (ANMS)(INFONET) and Local Notice to Mariner's (LNM's) will be used to enter appropriate information on appropriate charts or publications.

b. Instructions for Maintenance. The Chart and Publications Custodian, under the cognizance of the Assistant Navigator and CIC/CDC Officer will keep separate files, as follows:

(1) Notice to Mariners File. Notice to Mariners will be kept by each work center maintaining navigational charts and related publications must be retained on board for the date of the last correction applicable (annotated on the front cover) for the Catalog of Hydrographic Products.

(2) Local Notice to Mariners File. To be handled the same as Notice to Mariners and will be held on board for at least one year, or longer, as required.

(3) Summary of Corrections is a series of publications that incorporates a historic record of corrections dating from the latest edition date for NIMA products, dating back to July 1975.

(4) Classified Notice to Mariners provides the same information as the Notice to Mariners and Summary of Corrections except information is for classified charts and publications.

c. Responsibility. The Chart and Publications Custodian will maintain the Notice to Mariners File.

d. Retention. Notice for Mariners records will be kept for one year or until issued in a summary document.

9. Navigation Safety Warning Messages. Including, but not limited to: HYDROPAC/LANT, NAVAREAS, NAVTEX, NAVINFONET, SAFETYNET, and Coast Guard Local Broadcast Warnings, and their web site (<http://www.navcen.uscg.mil/lnm/default.htm>), as applicable.

a. Purpose. To maintain a file of the latest navigational aid discrepancies and hazards to navigation.

b. Instructions for Maintenance and Review. File all Safety Warning Messages chronologically by number, and logged on a Safety Messages Cover Sheet (See Appendix F). Attach a review signature sheet and "Safety Warning Messages in Effect for the Local OPAREA" status sheet to the front cover. Provide copies to each work center keeping charts.

(1) At sea, route Safety Warning Messages to the OOD, Navigator and Assistant Navigator/Senior Quartermaster, with a copy to the QMOW and CIC/CDC Watch Officer for the Safety Warning Message file. In port, route Safety Warning Messages to the Duty Quartermaster and Duty Operations. When received, they will be reviewed to determine pertinent information that should be immediately brought to the attention of the OOD (at sea), and to the attention of the Navigator or Senior Quartermaster.

(2) The Navigator will brief the Commanding Officer on pertinent information from Safety Warning Messages during navigation briefs and at any other time when the information is useful.

c. Responsibility. The Safety Warning Messages File will be maintained by the Chart and Publications Custodian.

d. Retention. Safety Warning Messages will be kept until they expire.

10. The Magnetic Compass Record (NAVSEA 3120/3)

a. Purpose. The Magnetic Compass Record is a complete record of all magnetic compass readings and comparative true headings. It is also a record of gyro errors.

b. Instructions for Maintenance. While the ship is underway, compute gyro error and navigational/conning gyro repeater errors daily and record in the remarks column of each page. Enter LAT/LONG of current position when practicable.

(1) A separate log for the computation of repeater error may be used which should also record the computed gyro error, but this log does not obviate the requirement to record computed gyro errors in the Magnetic Compass Record.

(2) Compass comparisons between the magnetic compass and the helm repeater in use for steering will be made and recorded every half hour and every time a new ordered course is steered, when practicable.

(3) Compute helm repeater error and record every 4 hours, comparing the master gyro/INS to the helm steering repeaters.

(4) Make compass checks any time a gyro compass alarm is received.

(5) If the steering repeater and the heading source do not correspond within 1.0 degree at the time of obtaining a compass check, immediately repeat the check for possible error in reading. If there is still an error, immediately inform the OOD, Navigator, Assistant Navigator and leading IC technician. Additionally, if the SINS and gyros do not agree within 1.0 degree, inform the OOD and Navigator immediately.

c. Responsibility for review and approval. The Navigator will review and sign the Magnetic Compass Record daily and submit the record to the Commanding Officer on the last day of each quarter for his/her signature.

d. Retention. The Magnetic Compass Record will be kept on board for 1 year after the date of the last entry as part of the ship's official records.

#### 11. Ship's Position Reports (NAVSHIP 9240/1)

a. Purpose. To provide a means of reporting the ship's position.

b. Instructions for Maintenance. Ship's Position Report, NAVSHIPS Form 9240/1 or locally prepared forms, may be used if containing, as a minimum, that information provided on the NAVSHIPS form (See Appendix G). Each day at sea, before 0800, 1200, and 2000, the Navigator will prepare, or cause to have prepared, a Ship's Position Report. After the Navigator has signed the Ship's Position Report, deliver the original copy to the Commanding Officer and embarked staff at the appropriate time. A copy will be placed in a file kept in the chart house and CIC/CDC will receive a copy. Additionally, the 0800, 1200, and 2000 position will be logged in the Ship's Deck Log. Ensure that correct security classification of the report is indicated. When a senior officer is embarked, provide a copy of each position report to him/her unless otherwise directed.

c. Responsibility for Review and Approval. The Navigator (or Assistant Navigator if authorized by ship's navigation bill) is responsible for reviewing the Ship's Position Reports and will approve them by signature, before submission to the Commanding Officer.

d. Retention. The duplicate Ship's Position Report will be kept by the Navigator as may be convenient, but will not normally be kept beyond the end of the month or duration of the voyage, whichever is greatest.

#### 12. Captain's Night Order Book

a. Purpose. Captain's Night Order Book contains the orders of the Commanding Officer for the operation and safe navigation of a ship underway during the night.

b. Instructions for Maintenance. The Night Order Book is kept in bound ledger or loose-leaf form. The orders for each night are written on a separate sheet and signed by the Commanding Officer. They include such items as courses and speeds, expected sightings, engineering data, the tactical

situation and composition of the formation, and supplementary orders to the Officer of the Deck. This book forms a permanent part of the ship's records. approval.

c. Responsibility. The Navigator is responsible for preparing and submitting the Captain's Night Order Book to the Commanding Officer for approval.

d. Retention. Keep for 3 years after the last dated entry.

13. Navigation Brief

a. Purpose. To provide a plan for safe and prudent passage including piloting in restricted waters.

b. Instructions for Maintenance. The Navigator is charged with supervising the preparation and presentation of each Navigation Brief per Appendix B. The Navigator will sign the file copy.

c. Responsibility for Review and Approval. The Executive Officer will review the brief on ships when the Navigator is below the rank of Commander. The Commanding Officer will approve and sign the Navigation Brief file copy before its presentation.

d. Retention. Keep the Navigation Brief on file as required, but no less than 6 months.

APPENDIX A

NAVIGATION CHECKRIDE LIST

(To be conducted at the discretion of the Commanding Officer)

ITEM	YES	NO
1. Is there a tailored navigation bill that prescribes responsibilities and procedures for safe navigation of the ship, including navigation in restricted waters during low visibility? (Ref OPNAVINST 3120.32C, Arts. 630.13 and 630.13.5)		
2. Is the Watch, Quarter and Station bill current, complete, and readily available to navigation personnel? (Ref OPNAVINST 3120.32C, Art. 610)		
a. Does the organization provide for and designate personnel to pilot the ship:		
(1) During special sea and anchor detail?		
(2) During general quarters?		
(3) During low visibility?		
(4) During special evolutions?		
3. Are the watch personnel PQS qualified for their assigned positions and appropriate service record entry completed?		
4. Are qualified senior and experienced personnel on the watch bill as watch supervisors and/or assigned to training teams to ensure the thorough and professional performance of the watch teams?		
5. Verify the following logs and records are on board, up to date and properly maintained:		
a. Deck Log (Ref OPNAVINST 3100.7B).		
b. Magnetic Compass Record Book (OPNAVINST 3120.32C).		

c. Bridge-Bridge R/T log properly maintained?		
d. Navigation Workbook (Ref OPNAVINST 3530.3B).		
e. Standard Bearing Book (Ref OPNAVINST 3530.3B).		
f. Ship's Position Log (OPNAV 3100/3 6-76).		
g. Weather Observation Log (Ref NAVMETOCCOMINST 3144.1D).		
h. Surface Radar Contact Log.		
i. CIC Watch Log.		
j. Radar Navigation Fix Log.		
k. Radar and Visual Navigation Points Listing.		
6. Is the CO's Night Order Book properly maintained and contain a copy of the CO's standing orders?		
7. Has ship control personnel (OOD, JOOD, TAO, CICWO, QMOW, EOOW, and BMOW) reviewed and initialed CO's Night Order Book?		
1. Has ship control personnel reviewed and initialed CO's standing orders monthly?		
9. Verify the following instructions and references are on board and up to date:		
a. OPNAVINST 3530.3B (Bearing and Navigation Workbook).		
b. OPNAVINST 3100.7B (Deck Log).		

c. CINCPACFLTINST 3140.3A or CINCLANTFLT 3140.9A (Chart and Pub requirements) and NIMA R05 listings.		
d. NAVMETOCCOMINST 3140.1K (Meteorological support).		
e. NAVMETOCCOMINST 3144.1D (Weather observation manual).		
f. Atlas of Pilot charts.		
g. Typhoon/Hurricane Havens Handbook.		
h. Tide and current tables.		
i. Weekly Notice to Mariners.		
j. Local Notice to Mariners.		
k. Summary of Chart/Pub Corrections.		
l. Navigation Safety Messages (with cover sheet for navigator's and assistant navigator's review).		
m. Nautical Almanac.		
n. NIMA SRPUB 229 Vol. 1-5, NIMA SRPUB 249 Vol. 1-3 (Sight Reduction Tables).		
o. Catalog of Maps, Charts and Related Products(with semiannual bulletin).		
p. COMNAVSURFPACINST 3180.2G or COMNAVSURFLANTINST 9010.1F (Replenishment Guide).		
q. NIMA NVPUB Pub 9 (Bowditch).		



r. Chart #1 (Chart Symbols).		
s. Degaussing Folder.		
t. COMDTINST M16672.2C (Rules of the Road).		
u. Light List, List of Lights.		
v. Coast Pilots.		
w. Fleet Guides.		
x. Sailing Directions.		
y. Port Directory.		
z. NIMA NVPUB 1310 (Radar NAV Manual).		
aa. NIMA NVPUB 217 (Maneuvering Board Manual).		
bb. NIMA RAPUB 117 (Radio NAVAIDS).		
cc. NIMA NVPUB 150 (World Port Index).		
dd. NIMA NVPUB 151 (Distances Between Ports).		
ee. Updated associated publications (technical and operator) for all installed navigational equipment.		
10. Has the Commanding Officer specified in writing which ready charts and publications are to be kept corrected up to date? (Ref OPNAVINST 3120.32C, Art. 323 and Art. 630.13.4)		

11. Verify the following are maintained on board:		
s. Full allowance of chart portfolios.(Ref CINCPACFLTINST 3140.3A or CINCLANTFLTINST 3140.9A)		
b. Chart and pub correction cards for the full chart and pub allowance and checked through the latest Notice to Mariners and Local Notice to Mariners.		
12. Are appropriate steering casualty procedures available at all steering stations with individual responsibilities covered?		
13. Are Speed and RPM tables posted at all conning stations?		
14. Was the gyro error and repeater error determined daily, reported to all navigation users, dated, and posted on all gyro repeaters and logged in the Magnetic Compass Record Book, Bearing Book, and Deck Log?		
15. Was the radar range and bearing error determined prior to getting underway, dated, and posted on all radar repeaters and logged in the Standard Bearing Book and CIC/CDC Watch Log?		
16. Are excerpts from the Act to Prevent Pollution from Ships, 1983 and the Clean Water Act of 1977 available to the OOD? (OPNAVINST 5090.1B)		
17. Are ship's tactical data tables available to the OOD and NAV/CIC/CDC plots?		
18. Are checklists available for the following navigation evolutions:		
a. Leaving/Entering Port.		
b. Low Visibility.		
c. Swept Channel piloting.		

d. Special Evolutions (i.e., Replenishment at Sea, Fueling at Sea, Flight Quarters, etc.).		
19. Are foreign articles stowed away from all electric and electronic equipment?		
20. Are operating instructions available for all electronic equipment?		
21. Is all emergency lighting in operating condition?		
22. Verify the following Navy Standard Magnetic Compass(NSMC) and/or Digital Flux Gate Magnetic Compass (DFGMC) checks have been properly conducted:		
a. NSMC: Have all dockside checks been completed for all magnetic compasses tested and results recorded in the Magnetic Compass Record? (Ref NIMA PUB 9)		
b. NSMC: Have all magnetic compasses been adjusted within the past 12 months or since the last overhaul? (Ref NSTM 420)		
c. NSMC: Is the observed deviation within 3 DEG (degaussing off) and 5 DEG (degaussing on) (Ref NSTM 420)?		
d. NSMC: Is a current copy of the deviation table posted at or near each magnetic compass and NAV/CIC/CDC plots?		
c. NSMC: Do the observed deviations in the magnetic compass record tables correspond to the deviation tables?		
d. NSMC: If the NSMC is still on the ship but not in use, is it in lay-up with an "Out of Commission" sticker placed on the compass in plain view of the helmsman?		
f. DFGMC: Does the Navigation Team demonstrate a working knowledge of DFGMC operation to include Continuous and Intentional Auto-Compensation (as it applies to compass deviation), Pre-Set Variation, and compass limitations?		

g. DFGMC: Is the DISPLAY RESPONSE DAMPING set at "FAST" in restricted waters?		
h. DFGMC: Is AUTO-COMPENSATION mode set continuously?		
i. DFGMC: Has the Commanding Officer set policy guiding the use of PRE-SET VARIATION in the Ship's Navigation Bill?		
j. DFGMC: Has the ALIGNMENT ERROR ADJUSTMENT been completed following System installation, following removal/replacement of the processor unit or at least annually?		
k. DFGMC: INTENTIONAL AUTO-COMPENSATION completed at least 24 hours prior to operating in restricted maneuvering (as the operating environment allows)?		
23. Is the degaussing folder properly maintained and utilized?		
24. Verify the following navigation equipment is available and in satisfactory operating condition:		
a. Steering casualty alarm.		
b. Gyro repeaters (error posted and determined daily).		
b. Gyro alarm.		
c. Gyro repeater benchmark alignment.		
d. Bridge/CIC/CDC radar repeaters (error posted and determined daily).		
e. Navigation lights/Telltale Panel.		
f. Ship's whistle.		

g. Bell and gong (with lanyards attached).		
h. Fathometer.		
i. Electronic Navigation Equipment.		
j. EM speed log (calibrated IAW PMS).		
k. DRAI.		
l. Chronometers.		
m. Sextants.		
n. Stadimeter.		
o. Alidades and bearing/azimuth circles.		
p. 3-arm protractor.		
q. Barometer (valid calibration sticker).		
r. Degaussing system.		
s. Primary and secondary navigation radar (as applicable).		
t. Fire Control Radar.		
u. DRT/DDRT.		
v. STELLA Program.		

25. Are the optimum scale charts available, used at NAV/CIC/CDC plots, and corrected through the latest Notice to Mariners and local Notice to Mariners?		
26. Verify Bridge and CIC/CDC navigation charts are properly prepared with:		
a. Tracks labeled with true and magnetic courses, speeds and distances of each leg.		
b. Turn bearing and ranges based on ship's tactical data and labeled with true and relative bearings and distance to the turn.		
c. Advance and transfer data based on speed and rudder angle labeled for each turn.		
d. Danger bearings and/or ranges where dangers and shoal water are not marked by NAVAIDS.		
e. Chart shift points (Bridge and CIC/CDC shift points will not occur simultaneously).		
f. Shoal water and isolated dangers highlighted.		
g. Signature box for "prepared by," "submitted by" and "approved by."		
h. Visual and radar navigation points identical for Bridge and CIC/CDC, and indexed in the Standard Bearing Book and CIC/CDC Navigation Log.		
i. Slide bar annotated on all turns.		
j. Local speed restrictions annotated.		
k. Range Scales (as appropriate).		

27. Was the ship's draft determined and logged in the deck log before leaving/entering port?		
28. Are communications on the navigation circuits checked before leaving/entering port?		
29. Was a time check conducted over the LMC circuit before transiting restricted waters and logged in the deck log?		
30. Are tides and currents graphed and posted at all navigation stations for each reference station passed and computations entered in the navigation workbook or computer program?		
31. Was a navigation brief held before transiting restricted waters?		
32. Was the Bridge-Bridge R/T operational and tested before leaving/entering port and results documented in the R/T log?		
33. During piloting, were fixes taken as the situation dictated IAW table 2A?		
34. Were fixes properly labeled and contained at least three LOPs?		
35. Were DRs laid out from each fix at least two fix intervals, including beyond a turn, and labeled with times? (Regardless of whether on track or not)		
36. Was set and drift determined once on track legs less than 1000 yards and every third fix on longer legs and logged in the Deck Log?		
37. Did CIC/CDC take fixes concurrently with the Bridge?		
38. Was CIC/CDC fix information reported to the Bridge in the format of the Navigator Evaluator's report?		

39. Is radar repeater error, gyro error and gyro repeater error applied when plotting fixes?		
40. Do the Navigation Evaluator's fix reports to the Conn include the following information:		
a. Fix time.		
b. Fix/EP.		
c. Fix method if other than primary means (i.e., Bridge visual, CIC/CDC radar, etc.).		
d. Fix position in relation to proposed track.		
e. Nearest hazard to navigation.		
f. Nearest aid to navigation.		
g. Corrected Fathometer sounding.		
h. Distance and time to next turn.		
i. Course on next turn (reported each leg and updated as changes occur).		
j. Any recommendation to regain/maintain proposed track.		
k. Report computed set and drift (once on each leg when less than 1000 yards and every third fix for legs greater than 1000 yards).		
l. The phrase "CIC/CDC concurs," "CIC/CDC does not concur," or "CIC/CDC has no fix."		



41. Was there an exchange of information between the Conn and the navigator after each fix report and did the Conn acknowledge the navigator's report?		
42. Was there an effective information flow between the Conn, CIC and the navigator regarding the piloting situation, ship's course and speed, and deviations from the proposed track?		
43. Is set and drift, advance and transfer applied when making course recommendations?		
44. Are new courses searched for shipping before turning and a report made to the Conn?		
45. If two successive fix intervals result in no fix, is appropriate action taken, such as slowing to bare steerageway or stopping, until a fix is obtained?		
46. Does the Navigator/Navigation Evaluator inform the Conn when to use International/Inland Navigation Rules?		
47. Does the navigation team adhere to and demonstrate familiarity with the Navigation Rules? (COMDTINST M16672.2C)		
48. Is the low visibility watch bill published before getting underway to facilitate immediate implementation?		
49. Under conditions of low visibility, did the OOD/JOOD order:		
a. Qualified Fog Lookouts.		
b. Anchor(s) to be manned and ready for letting go when in restricted waters?		
c. Material condition Zebra to be set on the DC deck and below?		
d. Navigation lights turned on?		

e. Silence on the bridge, all hands on bridge to listen for and report sound signals?		
f. Appropriate fog signal to be sounded per the Navigation Rules?		
g. Was a safe speed ordered per the Navigation Rules?		
h. Were all uncorrelated fog signals identified and a determination made that a risk of collision did not exist before the ship proceeded on?		

APPENDIX B

NAVIGATION BRIEF

I. REQUIRED ATTENDANCE

Commanding Officer  
Executive Officer  
Operations Officer  
Navigator  
Chief Engineer  
Reactor Officer (when assigned)  
First Lieutenant  
CIC/CDC Officer  
Assistant Navigator  
CIC/CDC Surface Watch Officer  
Piloting and Shipping Officers  
Geophysics Officer/AG (when assigned)  
Helm Safety Officer  
Bridge Sea and Anchor Detail Team (OOD, JOOD, JOOW, Conning Officer)  
Senior QM and OS  
Staff Surface Operations Officer (when assigned)  
Other personnel as directed

II. SEQUENCE OF EVENTS:

A. ARRIVAL/DEPARTURE TIME - Navigator

1. Consideration of options

- a. Tides.
- b. Currents.
- c. Operational Requirements.
- d. Speed Restrictions.

2. Operational Requirements

- a. Conditions of readiness.
- b. Tactical situation.

B. WEATHER - Geophysics Officer/AG/Navigator

C. TIDES/CURRENTS - Navigator

1. Tides graphed using the Quarter/Tenth method, for the 12 hours preceding and following scheduled arrival or departure time.

2. Currents graphed using straight line graph.

3. Ebb/Flood velocity and directions at max velocity noted on graph. Tides/Currents posted at all Ship Control stations with copies to CO, XO, NAV, OOD, CONNING OFFICER, etc.

D. ASTRONOMICAL DATA - Navigator: Sunrise, sunset, moonrise, and moonset.

E. CHARTS - Navigator

1. Latest editions and corrections verified.
2. Corrections/changes since last brief.
3. Type of buoyage system.

F. TRACK - Conning Officer

1. Courses.
2. Turn/Danger bearings and ranges.
3. Designated Shoal Water and Danger Soundings.
4. Depth of water for channel, turning basin, etc.
5. CIC/CDC and Bridge charts compared.
6. Visual and radar NAV points.
7. Vessel traffic separation scheme.
8. Line of Demarcation.
9. Degaussing area.
10. Anticipated traffic.
11. Pier heading.
12. Description of anchorage or mooring.
13. Type of bottom (anchorage).
14. Head/drop bearings.
15. Amount of anchor chain required.
16. Check IN/OUT points along a Narrow Channel or Vessel Traffic Separation Scheme.

G. GROUND TACKLE - First Lieutenant

1. Ready anchor - PORT/STBD/CENTERLINE.
2. Scope of chain.
3. Status of windlass/winches.
4. Special mooring buoy procedures.
5. Mooring plan.
6. Let go or walk out to certain scope.

H. SIGNIFICANT TRAFFIC - Operations Officer

1. Entering/departing movements.
2. Harbor special events.
3. Media coverage.

I. TUGS AND PILOTS - Navigator

1. Tug/Pilot pick up/drop off point/time.
2. Communications.

J. STATUS OF NAV EQUIPMENT - Navigator

1. Compass/repeater errors.
2. Down equipment, impact and ETR.
3. Backup systems.
4. ECDIS-N Navigational Systems.

K. STATUS OF ENGINEERING PLANT - Chief Engineer

1. Limiting casualties.
2. Degaussing monitors.

L. SPECIAL CONSIDERATIONS/EVENTS - Navigator

1. Honors.
2. Flag Officer movements.
3. Visitors.
4. Helo ops (FOD/VERTREP/Pax Transfer).
5. Boats in the water.
6. Harbor exercises.
7. Accommodation ladder up/down.
8. Debrief schedule.
9. Hot areas.
10. Uniform.
11. Watch Bill.

M. EMERGENCIES - OOD

1. Steering/Engineering casualties.
2. Man overboard.
3. Loss of gyros, RADAR and communications.
4. Reduced visibility.
5. Emergency anchorage locations.

III. REVIEW/RETENTION

- A. Navigator will sign and forward for review and approval.
- B. For ships with Navigator below the rank of Commander, forward to Executive Officer for review and signature, and forward to Commanding Officer for approval.
- C. Commanding Officer will approve and sign.
- D. Navigator will maintain file copy as required, but no less than 6 months.

APPENDIX C

LOW VISIBILITY CHECKLIST

- \_\_\_\_\_ 1. Station the low visibility detail.
- \_\_\_\_\_ 2. Order ZEBRA SET MAIN DECK AND BELOW.
- \_\_\_\_\_ 3. Energize navigation lights.
- \_\_\_\_\_ 4. Order SILENCE ON THE BRIDGE.
- \_\_\_\_\_ 5. Sound fog signals according to inland/international rules of the road.
- \_\_\_\_\_ 6. Shift radio circuits to CIC/CDC.
- \_\_\_\_\_ 7. Check settings on bridge to bridge radio.
- \_\_\_\_\_ 8. The Commanding Officer will determine which plot is to be designated as primary, but the bridge will plot by WRN-6 (GPS), CIC/CDC will retain a radar plot with WRN-6 (GPS) back-up (if available).
- \_\_\_\_\_ 9. Slow to safe speed.
- \_\_\_\_\_ 10. Open bridge wing doors.
- \_\_\_\_\_ 11. If at trail shaft, order split plant (if applicable).

MINE COUNTERMEASURES/SWEPT CHANNEL CHECKLIST

24 HR PRIOR:

Consolidate mine threat intelligence (floating/ bottom/influence/mag/acoustic).	ISC _____
Determine transit route and time (consider tides, currents, depths).	NAV/_____ CICO _____
Conduct brief (concurrent with NAV brief).	NAV _____
Review/verify Quiet Ship Bill.	ENG/ASWO _____
Verify degaussing is operational.	ELECO _____
Secure cathodic protection.	EMO _____
Verify lifeboat list is current.	1 <sup>ST</sup> LT _____

1 HR PRIOR:

Conduct noise survey IAW EOSS MLOC.	ENG _____
Ensure all personnel possess inflatable life preservers.	1 <sup>ST</sup> LT _____
Set Quiet Ship Condition Q1 or Q2 (at CO's discretion).	OOD _____
Every 15 minutes, pass word: "The ship will enter a mine danger area in ____ minutes."	OOD _____
Pass word: "Secure all missile hazards throughout the ship."	OOD _____
Brief mine watch personnel.	CICWO _____
Set modified material condition ZEBRA main deck and below.	CICWO _____

30 MIN PRIOR:

Prepare mine reports.	CICWO _____
Ensure prairie/masker air is energized.	EOOW _____
Display lights/day shapes for ship restricted in Ability to maneuver.	OOD _____
Man repair lockers.	DCA _____
All topside personnel don life preservers and helmets.	OOD _____
Station mine watch detail with bins.	OOD _____
Station anchor detail (if applicable).	OOD _____

Station leadsman (if applicable). OOD \_\_\_\_\_  
10 MIN:

Secure fathometer. OOD/ASWO \_\_\_\_\_

Pass word:  
"The ship will enter a mine danger area in ten OOD \_\_\_\_\_  
minutes. All personnel not on watch remain  
inside the skin of the ship. All non-essential  
personnel lay to the second deck or above."

Make the anchor ready for letting to (if applicable) 1<sup>ST</sup> LT \_\_\_\_\_

Shift DRT trace to 1000 yd scale. CICWO \_\_\_\_\_

UPON ENTERING MDA:

Transit at slowest possible speed (7 kts or less if OOD \_\_\_\_\_  
not swept).

Pass word:  
"The ship has entered a mine danger area. All OOD \_\_\_\_\_  
personnel not on watch remain inside the skin  
of the ship. All non-essential personnel lay  
to the second deck or above."



APPENDIX D

STANDARD DAY'S WORK IN NAVIGATION

OPEN OCEAN NAVIGATION. Weather permitting, minimum daily celestial activity will include the following "Day's Work In Navigation":

Morning Twilight: Usually 45 minutes before sunrise, shoot available celestial bodies; to include selected stars, planet(s), the moon and Polaris. Reduce sightings to LOPs, plot on plotting sheet and determine ship's position. Advance celestial fix to 0800, for 0800 Ship's Position Report. Transfer fix to track chart. Inform CIC/CDC of position.

Early Morning: Determine gyro error by azimuth/amplitude of sun or other celestial body. Include any gyro error noted in 0800 and 1200 Ship's Position Report.

08-12: QMOW compute watch time of LAN (Local Apparent Noon).

0800: Submit 0800 Ship's Position Report to Commanding Officer, after being reviewed and signed by the Navigator.

Morning: Shoot sun to determine LOP. Plot on plotting sheet.

Mid-morning: Shoot sun to determine LOP. Plot on plotting sheet.

Noon: Observe LAN. Recommend observations be started at 10 minutes before computed time of LAN, and for a couple of minutes after. Reduce sighting and determine ship's latitude. Advance mid-morning sun LOP to LAN, LOP on plotting sheet, for running fix. Plot running fix on track chart and pass fix information to CIC/CDC. Advance sun LOPs to 1200, for 1200 Ship's Position Report.

1200: Submit 1200 Ship's Position Report to Commanding Officer, after being reviewed and signed by the Navigator.

Afternoon: Shoot sun to determine LOP. Plot LOP on plotting sheet. Advance LAN LOP to afternoon LOP, on plotting sheet, for running fix. (Minimum 3 Sun Lines for R-Fix.) Plot running fix on track chart and pass fix information to CIC/CDC.

Mid-Afternoon: Shoot sun to determine LOP. Plot LOP on plotting sheet. Advance afternoon LOPs to establish an R-Fix. Plot on track chart and pass information to CIC/CDC.

12-16: QMOW determine time of sunset and star time. Compute celestial bodies available, including planets.

Late Afternoon: Determine gyro error by azimuth/amplitude of sun or other celestial body. Include any gyro error computed in 2000 Ship's Position Report.

Evening Twilight: Usually 30 minutes after sunset, shoot celestial bodies, to include selected stars, planet(s), moon and Polaris. Reduce sightings to LOPs, plot on plotting sheet and determine ship's position. Advance

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celestial fix to 2000, for 2000 Ship's Position Report. Transfer fix to track chart. Inform CIC/CDC of position.

2000: Submit 2000 Ship's Position Report to Commanding Officer, after being reviewed and signed by the Navigator.

1600-2000: QMOW determine time of sunrise and moonrise/set for Commanding Officer's Night Orders. Also compute star time for morning star shoot. Determine celestial bodies available, including planet(s).

0000-0400: Compute Latitude by Polaris. Lines of position of the moon and planet(s), as available, and gyro error by Polaris.

All celestial work must be documented in the ship's Navigation Workbook with the navigator's signature at the end of each celestial day. When using the STELLA computer software, documentation of all observations must be maintained in a loose leaf binder.

APPENDIX E

QMOW WATCH TURNOVER CHECK LIST

INVENTORY

\_\_\_ CHRONOMETER COMPARISON/Report  
\_\_\_ submitted  
\_\_\_ NIGHT ORDERS  
\_\_\_ NAVIGATION BILL  
\_\_\_ QMOW PASS DOWN LOG  
\_\_\_ BEARING BOOK  
\_\_\_ POSITION LOG  
\_\_\_ NAUTICAL ALMANAC  
\_\_\_ MAGNETIC COMPASS BOOK  
\_\_\_ STAR LOG  
\_\_\_ NAVIGATION WORK BOOK  
\_\_\_ NAVIGATION RULES  
\_\_\_ CHART 1  
\_\_\_ VOYAGE PLANNING WORKSHEET  
\_\_\_ DECK LOG/EXTRA SHEETS  
\_\_\_ POSITION REPORT/EXTRA SHEETS  
\_\_\_ WEATHER OBSERVATION LOG/EXTRA  
SHEETS  
\_\_\_ 8/12/20 O'CLOCK REPORTS

CELESTIAL

SUNRISE/SUNSET\_\_\_\_\_/\_\_\_\_\_  
MOONRISE/MOONSET\_\_\_\_\_/\_\_\_\_\_  
AZIMUTH/AMPLITUDE\_\_\_\_\_  
SUN LINES/LAN\_\_\_\_\_  
STARS/PLANETS PREPARED\_\_\_\_

WEATHER

BAROMETER\_\_\_\_\_  
WIND\_\_\_\_\_  
AIR/SEA TEMPERATURE\_\_\_\_\_/\_\_\_\_\_  
HEAVY WEATHER MESSAGES PLOTTED\_\_\_\_\_  
LAST FAX/NEXT FAX \_\_\_\_\_

EQUIPMENT STATUS

RADAR\_\_\_GPS\_\_\_ DECCA \_\_\_  
LORAN-C\_\_\_SINS\_\_\_  
FATHOMETER\_\_\_\_\_  
MAIN/AUX GYRO\_\_\_\_/\_\_\_\_  
WSN\_\_\_EM LOG\_\_\_\_  
HELM REPEATER\_\_\_\_  
AFTER STEERING REPEATER\_\_\_\_  
MAGNETIC COMPASS\_\_\_\_  
BRIDGE WING Repeater's\_\_\_\_  
NAVSSI \_\_\_  
ECDIS-N Systems \_\_\_\_

INTENTIONS

D.R.COURSE/SPEED\_\_\_\_\_/\_\_\_\_\_  
FIX INTERVAL\_\_\_\_\_  
PIM TRACK COURSE\_\_\_\_\_  
PIM TRACK SPEED\_\_\_\_\_  
TRACK LEFT/RIGHT\_\_\_\_\_  
TRACK AHEAD/BEHIND\_\_\_\_\_  
NEXT TURN POINT/TIME\_\_\_\_\_/\_\_\_\_\_  
SET\_\_\_\_\_  
DRIFT\_\_\_\_\_  
CIC/CDC FIX COMPARISON\_\_\_\_\_  
EXPECTED AIDS/LANDFALL\_\_\_\_\_  
SHIPS IN COMPANY\_\_\_\_\_  
STEAMING FORMATION\_\_\_\_\_  
FORMATION GUIDE \_\_\_\_\_  
SENIOR QM

REMARKS:\_\_\_\_\_  
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NAVIGATOR

REMARKS:\_\_\_\_\_  
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APPENDIX F

NAVIGATION SAFETY WARNING MESSAGES

Msg No.	Chart/ Region	Warning	Msg No.	Chart/ Region	Warning	Msg No.	Chart/ Region	Warning

APPENDIX G

SHIP'S POSITION REPORT (NAVSHIP 9240/1)

1. Purpose. To provide a means of reporting the ship's position.
2. Format. Required information:
  - a. At (time of day) - 0800,1200,or 2000.
  - b. Date - the current date.
  - c. Latitude/Longitude - the DR LAT/LONG at 08, 12, or 20.
  - d. Determined at - the time of the fix from which the position was obtained.
  - e. By (indicate by check box.).
  - f. Set/Drift.
  - g. Distance made good since (Time) (Miles) - the distance traveled since the last report always computed from position report to position report.
  - h. Distance to - always to the ultimate destination.
  - i. ETA - the estimated time of arrival at the ultimate destination, expressed as a date/time group.
  - j. True heading - the heading of the ship corrected from gyro error.
  - k. Error - the gyro error previously computed.
  - l. Variation - the angular difference between the true north pole and the magnetic north pole, as determined from the chart compass rose.
  - m. Magnetic Compass Heading - (Check one) the magnetic compass check.
  - n. Deviation.
  - o. Table deviation - the deviation from Form 1104 that was predetermined for the magnetic compass.
  - p. DG (Indicate by check in box) - status of degaussing, on or off.
  - q. Remarks - additional information from the Navigator to the Commanding Officer.
  - r. Respectfully submitted (Navigator) - the Navigator's signature. CC - Carbon Copy, to embarked staff, CIC/CDC and (1) to file.
3. The QMOW/PLOT watch will fill out and submit the position report to the assistant navigator.

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4. Responsibility for review and approval. The Navigator is responsible for position reports. The Navigator will approve them by signature, before submission to the Commanding Officer, embarked staff, and CIC/CDC.
5. Disposition. The duplicate ship's position report will be kept as may be convenient.
6. Responsibility for maintenance. The Assistant Navigator is responsible for maintaining the file of duplicate position reports.

APPENDIX H

ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEMS-NAVY (ECDIS-N)

1. Electronic databases, operating systems, and computer technology have advanced, and the widespread deployment of digital display systems to the fleet has now made it possible to employ electronic charts at sea. In addition, the advent of continuous and automated positioning systems, such as the Global Positioning System (GPS) and Inertial Navigation System (INS), has made it possible to take maximum advantage of electronic charting, eliminating many constraining aspects of navigation by paper chart while significantly advancing safety of navigation. While the interim use of ECDIS-N systems for enhanced situational awareness is acceptable, U.S. Navy vessels may not use ECDIS-N systems in lieu of the requirement to maintain paper charts until the ECDIS-N systems are tested, certified, and approved for fleet introduction (initial operational capability) by the appropriate authority.

2. The Navy must ensure interoperability among various ECDIS-N systems and between ECDIS-N systems and other systems. Navy will achieve interoperability by mandating standards and functional requirements for ECDIS-N and associated electronic charts:

a. Navy standard automated and continuous positioning systems and approved navigation and piloting procedures will be used for position reference. In addition to accepting continuous position systems for navigation and piloting, ECDIS-N will accept radar and visual navigation fix information.

b. Department of Defense (DoD) standard products and datum will be employed as follows:

1. Standard products and services are defined as those which are produced by NIMA. NIMA produces all electronic charts on WGS-84, maintains these products, and provides them directly to the fleet.

2. World Geodetic System-84 (WGS-84) is the standard datum.

3. Vector Product Format (VPF) is the standard digital data format that will support ECDIS-N on board all U.S. Navy vessels.

4. The standard products that support navigation on board U.S. Navy vessels are defined as follows:

<u>Digital Product</u>	<u>Paper Equivalent</u>	<u>Classification</u>
Digital Nautical Chart (DNC)	General, Coastal Harbor, and Approach	Unclassified
Tactical Ocean Data (TOD) 0	OPAREA, Range markings	Distribution Limited
Tactical Ocean Data (TOD) 1	Bottom Contour	Confidential
Tactical Ocean Data (TOD) 2	Bathymetric Navigation Planning	Secret
Tactical Ocean Data (TOD) 3	TBD	As required
Littoral Warfare Data (LWD)	Combat Chart	Confidential
Vector Database Update (VDU)	Notice to Mariners	Depends on Product

3. ECDIS-N must incorporate safe navigation and piloting functionality at a minimum. ECDIS-N functionality is based on IMO Resolution A.817 (19) adopted on 23 November 1995 which is the International Maritime Organization (IMO) performance standards for Electronic Chart Display and Information Systems (ECDIS) as established for civil shipping. U.S. Navy vessels are not required to comply with IMO resolutions. In setting standards in keeping with safe maritime operations, however, Navy will follow DoD mandates to use commercial standards wherever possible. Therefore, deviations from the civil guidance will be limited to those required for unique military applications and approved naval navigation and piloting procedures. All electronic charting data used for navigation must be maintained using the most current NIMA databases and updates available.

4. ECDIS-N capability begins limited fleet introduction in FY98 to enhance situational awareness and initiate the transition to a certified ECDIS-N system. The goal is full fleet implementation by FY07. The Navy requirement for paper charts from NIMA as the primary source of navigation information will continue until all U.S. Navy vessels implement ECDIS-N. The Navy may also retain a limited requirement for paper charts beyond FY07 as one means of satisfying ECDIS-N backup requirements.



APPENDIX I

Digital Flux Gate Magnetic Compass

1. The Digital Flux Gate Magnetic Compass (DFGMC) is a replacement for the Navy standard magnetic compass designed to improve accuracy by removing deviation from the compass equation. Ship's design engineers have long battled the effect of steel hulls, degaussing, and various electrical systems each producing compass deviation. Annual swing-ship is designed to ensure compass compensating systems are properly set to minimize the effects of the shipboard environment and measure resulting deviation. This procedure is often tedious and on many ship classes still produces poor results. The DFGMC provides a solution by positioning the flux gate sensor atop the mast away from ship's magnetic fields, and incorporating an internal auto-compensating algorithm. DFGMC auto-compensation corrects for changes in ship's magnetic field each time a 360° turn is completed, setting the resulting compass deviation to zero. This feature allows the compass to correct for minute changes in magnetic signature and the local operating environment.

2. To properly utilize the DFGMC, compass operation, adjustment procedures and limitations must be thoroughly understood. These procedures can also be found in the DFGMC tech manual.

a. Operation. The DFGMC offers several functions not found on conventional compasses. It is imperative that key members of the navigation team understand these functions, and are aware of the compass' current operating mode. A summary and guidance of key features is offered below:

(1) SET COURSE MODE. A reference heading may be set in memory by pressing the "SET CRS" pushbutton in accordance with the technical manual. In this mode compass heading is displayed along with bar segments indicating deviation of current course from the reference heading in 5° increments. This mode does not detract from normal compass operation and may be implemented as the CO or OOD directs.

(2) DISPLAY RESPONSE DAMPING. This toggle switch selects one of three fixed values of display damping. In the "FAST" position, the display is updated every 3 seconds, in "MED" every 9 seconds, and in "SLOW" every 17 seconds. This switch should be set on "FAST" when operating in restricted waters. When operating in rough seas or at high speeds "MED" or "SLOW" may be selected to slow display updates.

(3) CONTINUOUS AUTO-COMPENSATION. In this mode, the DFGMC checks the stored calibration against present accuracy each time the ship completes a 360° turn over a two minute period. WHILE OPERATING IN RESTRICTED WATERS, THIS MODE WILL ALWAYS BE DISABLED. While at sea, this mode will always be enabled, except on small craft whose magnetic condition does not appreciably change. Continuous Auto-Compensation will help compensate for compass error caused by the ship's Degaussing System. To alert the operator that Continuous Auto-Compensation is enabled, the display will flash "CAL" and "ON" every minute, and return to the heading display.

(4) PRE-SET VARIATION. The DFGMC determines and displays MAGNETIC HEADING (COMPASS HEADING auto-compensated for DEVIATION). Local VARIATION may be pre-set in the compass to automatically convert magnetic heading to

true heading. The default setting is 0°, which equates to magnetic head. Variation depends greatly on one's position on the earth's surface. The Commanding Officer must set policy guiding the use of this function in the Ship's Navigation Bill. If used, the navigation team must be aware that compass heading equates to true heading, and no correction for variation is required. Procedures must also be in place to ensure that the setting is adjusted for local variation as listed on the current chart in use. The following guidance is promulgated:

(a) The compass will be set in accordance with ships doctrine (either to local variation, or 0° if not used) prior to entering or leaving port, and verified or updated each day underway in conjunction with checking gyro error. This may be completed in conjunction with (b) below.

(b) If pre-set variation is used, in addition to daily checks required in (a), it will also be checked against local variation each time that charts are shifted.

(c) Loss of Gyro procedures will include checking variation to ensure it is correctly set in accordance with ship's doctrine.

b. Adjustments

(1) ALIGNMENT ERROR ADJUSTMENT. This procedure is normally required only to correct for minor misalignments between the Processor Unit (containing the flux gate magnetic sensor) and the ship's centerline. Completion of this procedure is referenced in MIP 4211/017, MRCs R-1 or R-2 depending on which DFGMC model is installed. Alignment Error Adjustment must be conducted in conjunction with the appropriate MRC:

- Following system installation.
- Following removal/replacement of the Processor Unit.
- At least annually.

Degaussing may be energized or de-energized during the adjustment, as long as it is not changed. At least two auto-compensation procedures must be completed after degaussing is set, just prior to the adjustment procedure. The following steps provide specific guidance for the completion of Alignment Error Adjustment.

(a) Hold course in each of the four cardinal headings (000°, 090°, 180°, and 270°). As the ship steadies up on each course, record the difference between compass heading and ship's gyro heading (TRUE). Errors resulting from readings left of actual heading (WEST) are negative (-), and errors right of actual heading (EAST) are positive (+). The observed error between COMPASS HEADING and TRUE HEADING is compass DEVIATION + magnetic VARIATION.

(b) Apply local magnetic VARIATION to compass error on each cardinal heading to determine compass DEVIATION. If the resulting deviations are approximately the same and not zero, a sensor alignment correction is required.

(c) To determine the sensor alignment correction factor, Average the four cardinal heading deviations. If the resulting error is negative (WEST), the sensor correction factor is positive and vice versa.

(d) Enter the sensor correction factor in the DFGMC according to instructions in the tech manual. Remember negative errors (errors WEST, or left of actual heading) require a positive correction factor and positive errors require a negative correction factor.

(e) After entering the correction, ensure the DFGMC is not turned off for at least 10 sec in order for the new correction factor to be permanently stored in non-volatile memory.

(f) Record the sensor correction factor on the compass card and in the Deck Log. On the compass card, deviations observed on each of the four cardinal headings should be recorded in the appropriate column (DG ON or OFF) and the rest of the deviation entries left blank. The Compass Correction Factor should be recorded as a + or - value under "TYPE CC COILS" at the top of the card. "TYPE CC COILS" should be crossed out in ink and "CORRECTION FACTOR" entered in the space just above. All entries for magnet/sphere adjustments should be labeled as N/A. RECORDED DEVIATIONS ARE FOR DFGMC ADJUSTMENT ONLY, NOT FOR USE DURING NAVIGATION. Actual DFGMC deviation is zero if the correction factor is entered in the DFGMC and auto-compensation is current.

(2) INTENTIONAL AUTO-COMPENSATION. This procedure is required whenever compass heading is suspect. It should be the first course of action whenever changes in the magnetic environment may have affected compass accuracy, for example when degaussing is energized or de-energized, and when practical, prior to operating in restricted maneuvering. Procedural steps are outlined in MIP 4211/017, MRCs R-1 or R-2, depending on the DFGMC model installed, and are summarized below:

(a) Enter the DFGMC calibration mode as described in the operational/technical manual.

(b) Maintaining speed and rudder angle, complete two full 360° circles. Ensure turn rate does not exceed approximately 3° per second so that each turn takes more than two minutes to complete.

(c) Note the three digit calibration score as listed in the technical manual. The first digit indicates the quality of the compensation, and should be as close to "9" as possible. The second digit indicates the quality of the magnetic location of the sensor (1-9). On steel superstructure ships it should read at least "2", on aluminum superstructures at least "7". The final digit is a roll over counter indicating each time a new compensation has been accepted.

c. Limitations. Once the operation and adjustment procedures are completed, there are certain limitations that must be understood. Due to the nature of DFGMC auto-compensation, it is not always possible to complete the procedure when the magnetic environment changes; for example, after degaussing is energized the ship may not be able to immediately complete two 360° turns. A case to consider occurs when the ship leaves port. Degaussing may have been cycled through several states prior to a degaussing range run. Also, the DFGMC does not have compensation coils used with the Navy Standard Magnetic Compass (wet compass) and therefore has no capability to automatically compensate for changes in the ship's degaussing system. The following guidelines apply:

(1) Gyro Casualty. With a DFGMC, it is even more imperative to use magnetic checking courses to determine course to steer in the case of a gyro casualty. A loss of gyro can cause unpredictable fluctuations in ship's degaussing which in turn can affect the DFGMC. Intentional auto-compensation must be completed as soon as possible after degaussing is set in manual and stabilized. It is not always possible to complete auto-compensation procedures, and unlike a conventional magnetic compass, compass deviation can not be measured for later use in course calculations. The DFGMC heading must be considered suspect until verified, or until auto-compensation is completed.

(2) Auto-compensation should normally be completed within 24 hours prior to operating in a restricted maneuvering environment. Degaussing should be set in its intended mode of operation and not energized or de-energized following the check. As a rule, the procedure should be completed whenever steering checks are required; i.e. as a part of the "Entering Port" or "Underway Replenishment" checklist. This will ensure that the compass has been set with minimal deviation.

(3) If auto-compensation can not be completed, the ship will always attempt to keep degaussing set in the same position as during the last auto-compensation prior to entering restricted maneuvering. This will help minimize magnetic field changes that may effect the compass.

(4) If possible, the Navigator should study the effects of energizing and de-energizing degaussing on the DFGMC. This may help the Navigation Team predict the effects of degaussing.

3. The DFGMC is an authorized replacement for the conventional magnetic compass. As long as the operational and adjustment procedures are practiced, and compass limitations are well understood, the DFGMC offers accuracy with reduced maintenance. At the Commanding Officer's discretion, ships with both a conventional compass and DFGMC may place the conventional compass in lay-up in order to reduce maintenance requirements. In accordance with the ship's gauge calibration instruction, an "Out Of Commission" sticker will be placed on the compass in plain view of the helmsman. This may be on the compass face itself in order to obstruct compass reading.